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OPERATIONS ANALYSIS REPORT

AD895893

RESEARCH & ANALYSIS
PROJECT
SECTION

A SHORT SURVEY OF JAPANESE RADAR,
VOLUME III.

31 MAR 1948

20 November 1945

Prepared by

2d & 3d Operations Analysis Section, FEAF
and

Air Technical Intelligence Group, FEAF
(ATIG Report No. 115)

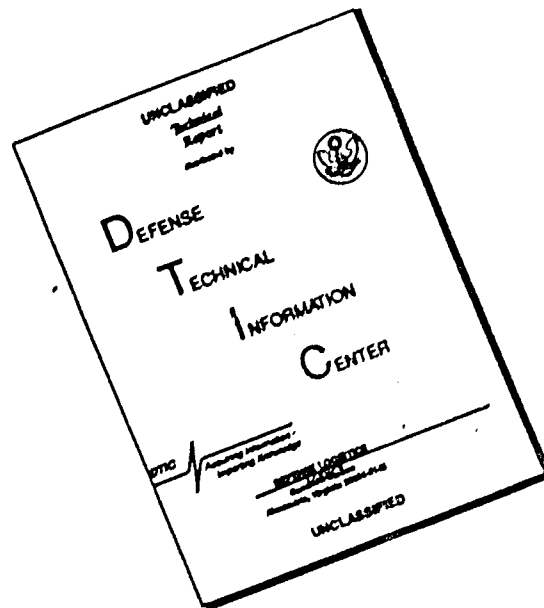
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A SHORT SURVEY OF JAPANESE RADAR

Volume III

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1. General. The same introductory remarks apply to the "Navy Radar Book" as to the "Army Radar Book" of Section IV (Volume II). In the following pages the principal navy sets are briefly described with block diagrams and with pictures where new ones taken in Japan are available. The Japanese Navy built a complete line of ground based early warning and fire control equipment quite independent of those used by the army. They also built airborne search and track radars for their bombers and night fighters which, while similar to the army's sets, were of their own design. The navy did not, however, build or operate any Type A (Doppler principle air warning) sets. The equipment described in this ~~section~~ ^{report} ~~then~~ will all be Type B (impulse principle), except for the FM low altitude altimeter.

The information and block diagrams were supplied principally by members of the electronics division of the Second Naval Technical Institute, Imperial Japanese Navy. Certain data, however, are from manufacturers and other sources.

A. Land-Based Radars

Prepared for the U.S.N., 5th Fleet.

TABLE OF RADARS OF THE JAPANESE

No.	Name	Designation	Object	Research started	Research finished	Remarks	Installation	Frequency (Mc)	Power Output (Peak)	Pulse Length	Repetition Frequency	Transmitter		Receiver		Scale
												Oscillator Circuit	Detector	Local Oscillator	Scale	
1	Mark-1 Model-4	14	Long range anti-air warning	1945	1945	5	Important: Search	50 Mc (9 Mc)	100 kW	20 μ s	250 Hz	TR-590A x2	8.5 Mc	UN-954	UN-955	120
2	Mark-3	RD	Anti-air warning	1941	1942	10	Important: Search and track	5 Mc	500 W	Continuous		P-220 x2	3.5 Mc, 200 Mc	UN-954	UN-955	75
3	Type-2 Mark-1 Model-1	11	Anti-air warning	1941	1942	4	Important: Search and track	180 Mc	5 kW	20 μ s	1000 Hz	TR-590A x2	215 Mc, 35 Mc	UN-954	UN-955	120
4	Type-2 Mark-1 Model-1-B	11-1	Anti-air warning	1941	1942	5	Important: Search and track	100 Mc	5 kW	20 μ s	1000 Hz	TR-590A x2	215 Mc, 35 Mc	UN-954	UN-955	120
5	Type-2 Mark-1 Model-1-2	11-2	Anti-air warning	1942	1943	5	Important: Search and track	100 Mc	40 kW	20 μ s	500 Hz	TR-590A x2	215 Mc, 35 Mc	UN-954	UN-955	120
6	Type-2 Mark-1 Model-1-3	11-3	Anti-air warning	1943	1943	7	Important: Search and track	100 Mc	40 kW	20 μ s	500 Hz	TR-590A x2	215 Mc, 35 Mc	UN-954	UN-955	120
7	Prototype Air Warning Radar	11-3A	Anti-air warning	1945	1945	5	Important: Search and track	100 Mc	40 kW	20 μ s	500 Hz	TR-590A x2	215 Mc, 35 Mc	UN-954	UN-955	120
8	Type-3 Mark-1 Model-3	11-3	Small size anti-air warning	1943	1943	8	Important: Search and track	150 Mc	10 kW	10 μ s	500 Hz	TR-590A x2	215 Mc, 35 Mc	UN-954	UN-955	75
9	Type-3 Mark-1 Model-1	11-3	Medium size anti-air warning	1943	1943	10	Important: Search and track	150 Mc	10 kW	10 μ s	500 Hz	TR-590A x2	215 Mc, 35 Mc	UN-954	UN-955	75
10	Type-2 Mark-1 Model-2	12	Portable anti-air warning	1942	1942	12	Important: Search and track	200 Mc	5 kW	10 μ s	1000 Hz	TR-590A x2	215 Mc, 35 Mc	UN-954	UN-955	120
11	Type-2 Mark-1 Model-2-2	12-2	Portable anti-air warning	1942	1942	12	Important: Search and track	150 Mc	5 kW	10 μ s	1000 Hz	TR-590A x2	215 Mc, 35 Mc	UN-954	UN-955	120
12	Type-2 Mark-1 Model-2-3	12-3	Portable anti-air warning	1942	1942	12	Important: Search and track	150 Mc	5 kW	10 μ s	1000 Hz	TR-590A x2	215 Mc, 35 Mc	UN-954	UN-955	120
13	Prototype Mark-4 Model-3	L1	Search light control	1942	1942	4	Important: Search and track	1.5 Mc	7 kW	4 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
14	Prototype Mark-4 Model-3-1	L2	Search light control	1942	1942	4	Important: Search and track	1.5 Mc	10 kW	2 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
15	Prototype Mark-4 Model-3-2	L3	Search light control	1942	1942	4	Important: Search and track	1.5 Mc	10 kW	2 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
16	Prototype Mark-4 Model-1	S1	Anti-aircraft fire control	1942	1942	8	Important: Search and track	1.5 Mc	10 kW	2 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
17	Prototype Mark-4 Model-2	S2	Anti-aircraft fire control	1942	1942	8	Important: Search and track	1.5 Mc	10 kW	2 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
18	Prototype Radar for A.A. Control	S3	Anti-aircraft fire control	1942	1942	8	Important: Search and track	1.5 Mc	10 kW	2 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
19	Prototype Mark-6 Model-1	61 (S4)	Anti-aircraft fire control	1944	1944	12	Important: Search and track	58 Mc	8 kW	2.5 μ s	3750 Hz (1800 Hz)	TR-590A x2	215 Mc, 35 Mc	UN-954	UN-955	75
20	Prototype Mark-6 Model-2	62	Anti-aircraft fire control	1945	1945	6	Important: Search and track	58 Mc	8 kW	2.5 μ s	3750 Hz (1800 Hz)	TR-590A x2	215 Mc, 35 Mc	UN-954	UN-955	75
21	Prototype Mark-6 Model-3	63	Anti-aircraft fire control	1945	1945	6	Important: Search and track	58 Mc	8 kW	2.5 μ s	3750 Hz (1800 Hz)	TR-590A x2	215 Mc, 35 Mc	UN-954	UN-955	75
22	Radar to guide boats	TH	To guide friendly boats	1944	1945	7	Important: Search and track	15 Mc	12 kW	2 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75

B. Shipboard Radars

No.	Name	Designation	Object	Research started	Research finished	Remarks	Installation	Frequency (Mc)	Power Output (Peak)	Pulse Length	Repetition Frequency	Transmitter		Receiver		Scale
												Oscillator Circuit	Detector	Local Oscillator	Scale	
1	Type-3 Mark-1 Model-3	13 (S5)	Anti-air warning	1943	1944	2	Both sides of Mizzen mast	2 Mc	10 kW	10 μ s	500 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
2	Type-3 Mark-1 Model-3	13 (S6)	Anti-air warning	1943	1944	2	Both sides of Mizzen mast	2 Mc	10 kW	10 μ s	500 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
3	Type-3 Mark-1 Model-3	13 (S7)	Anti-air warning	1943	1944	2	Both sides of Mizzen mast	2 Mc	10 kW	10 μ s	500 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
4	Type-3 Mark-1 Model-3	13 (S8)	Anti-air warning	1943	1944	2	Both sides of Mizzen mast	2 Mc	10 kW	10 μ s	500 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
5	Type-2 Mark-2 Model-1	21	Anti-air warning	1942	1942	4	Foremast	1.5 Mc	5 kW	10 μ s	1000 Hz	TR-590A x2	215 Mc, 35 Mc	UN-954	UN-955	120
6	Type-2 Mark-2 Model-1	21-1	Anti-air warning	1942	1942	4	Foremast	1.5 Mc	5 kW	10 μ s	1000 Hz	TR-590A x2	215 Mc, 35 Mc	UN-954	UN-955	120
7	Type-2 Mark-2 Model-1	21-2	Anti-air warning	1942	1942	4	Foremast	1.5 Mc	5 kW	10 μ s	1000 Hz	TR-590A x2	215 Mc, 35 Mc	UN-954	UN-955	120
8	Type-2 Mark-2 Model-1	21-3	Anti-air warning	1942	1942	4	Foremast	1.5 Mc	5 kW	10 μ s	1000 Hz	TR-590A x2	215 Mc, 35 Mc	UN-954	UN-955	120
9	Type-2 Mark-2 Model-1	21-4	Anti-air warning	1942	1942	4	Foremast	1.5 Mc	5 kW	10 μ s	1000 Hz	TR-590A x2	215 Mc, 35 Mc	UN-954	UN-955	120
10	Type-2 Mark-2 Model-1	21-5	Anti-air warning	1942	1942	4	Foremast	1.5 Mc	5 kW	10 μ s	1000 Hz	TR-590A x2	215 Mc, 35 Mc	UN-954	UN-955	120
11	Type-2 Mark-2 Model-1	21-6	Anti-air warning	1942	1942	4	Foremast	1.5 Mc	5 kW	10 μ s	1000 Hz	TR-590A x2	215 Mc, 35 Mc	UN-954	UN-955	120
12	Type-3 Mark-2 Model-3	23 (S9)	Anti-air warning	1943	1944	3	Foremast	2 Mc	5 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
13	Type-3 Mark-2 Model-3	23 (S10)	Anti-air warning	1943	1944	3	Foremast	2 Mc	5 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
14	Prototype Mark-2 Model-2	22 (S11)	Anti-air warning	1941	1942	6	Foremast	1.5 Mc	5 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
15	Prototype Mark-2 Model-2	22-1	Anti-air warning	1942	1942	12	Foremast	1.5 Mc	5 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
16	Prototype Mark-2 Model-2	22-2	Anti-air warning	1942	1942	12	Foremast	1.5 Mc	5 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
17	Prototype Mark-2 Model-2	22-3	Anti-air warning	1942	1942	12	Foremast	1.5 Mc	5 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
18	Prototype Mark-3 Model-1	220	Anti-air warning	1944	1945	3	Foremast	1.5 Mc	5 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
19	Prototype Mark-3 Model-1	105 S1	Anti-air warning	1944	1945	3	Foremast	1.5 Mc	5 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
20	Prototype Mark-3 Model-2	105 S2	Anti-air warning	1944	1945	3	Foremast	1.5 Mc	5 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75

C. Airborne Radars

No.	Name	Designation	Object	Research started	Research finished	Remarks	Installation	Frequency (Mc)	Power Output (Peak)	Pulse Length	Repetition Frequency	Transmitter		Receiver		Scale
												Oscillator Circuit	Detector	Local Oscillator	Scale	
1	Type-3 Air Mark-6 Model-4 Radar	H-6	Search and track	1941	1942	9	Large aircraft, search and track	2 Mc	10 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
2	Type-3 Air Mark-6 Model-3 Radar	FM-3	Search and track	1941	1942	9	Large aircraft, search and track	2 Mc	10 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
3	Prototype 19 Air Mark-1 Model-2 Radar	FM-4	Search and track	1941	1942	9	Large aircraft, search and track	2 Mc	10 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
4	Prototype 19 Air Mark-1 Model-2 Radar	FM-5	Search and track	1941	1942	9	Large aircraft, search and track	2 Mc	10 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
5	Prototype 19 Air Mark-1 Model-2 Radar	FM-6	Search and track	1941	1942	9	Large aircraft, search and track	2 Mc	10 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
6	Prototype 19 Air Mark-1 Model-2 Radar	FM-7	Search and track	1941	1942	9	Large aircraft, search and track	2 Mc	10 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
7	Prototype 19 Air Mark-1 Model-2 Radar	FM-8	Search and track	1941	1942	9	Large aircraft, search and track	2 Mc	10 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
8	Prototype 19 Air Mark-1 Model-2 Radar	FM-9	Search and track	1941	1942	9	Large aircraft, search and track	2 Mc	10 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
9	Prototype 19 Air Mark-1 Model-2 Radar	FM-10	Search and track	1941	1942	9	Large aircraft, search and track	2 Mc	10 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
10	Prototype 19 Air Mark-1 Model-2 Radar	FM-11	Search and track	1941	1942	9	Large aircraft, search and track	2 Mc	10 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
11	Prototype 19 Air Mark-1 Model-2 Radar	FM-12	Search and track	1941	1942	9	Large aircraft, search and track	2 Mc	10 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
12	Prototype 19 Air Mark-1 Model-2 Radar	FM-13	Search and track	1941	1942	9	Large aircraft, search and track	2 Mc	10 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
13	Prototype 19 Air Mark-1 Model-2 Radar	FM-14	Search and track	1941	1942	9	Large aircraft, search and track	2 Mc	10 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75

D. Land-Based and Shipboard Radar Counter Measures

No.	Name	Designation	Object	Research started	Research finished	Remarks	Installation	Frequency Band (Wave length)	Power Output (Peak)	Pulse Length	Repetition Frequency	Transmitter		Receiver		Scale
												Oscillator Circuit	Detector	Local Oscillator	Scale	
1	Radar Counter Measure	1	Search and track	1941	1942	9	Large aircraft, search and track	2 Mc	10 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
2	Radar Counter Measure	2	Search and track	1941	1942	9	Large aircraft, search and track	2 Mc	10 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
3	Radar Counter Measure	3	Search and track	1941	1942	9	Large aircraft, search and track	2 Mc	10 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
4	Radar Counter Measure	4	Search and track	1941	1942	9	Large aircraft, search and track	2 Mc	10 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
5	Radar Counter Measure	5	Search and track	1941	1942	9	Large aircraft, search and track	2 Mc	10 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
6	Radar Counter Measure	6	Search and track	1941	1942	9	Large aircraft, search and track	2 Mc	10 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75
7	Radar Counter Measure	7	Search and track	1941	1942	9	Large aircraft, search and track	2 Mc	10 kW	10 μ s	1000 Hz	TR-590A x2	15 Mc	UN-954	UN-955	75

Transmitter		Receiver		Scope Representation		Antenna		Max. Range	Accuracy	Distance	Accuracy	Angle	Score Parts	No. of Operators	Degree of Difficulty	Maintenance	No.
Model	Modulation	Frequency	Detector	Local Oscillator	Display	Auto Scale	Type	Gain	Beam Angle	Maximum Elevation	of Range	of Bearing	of Direction				
TR-390A	x 2	8.5 Mc.	UN 954	UN 955	120	Linear	Electric	Multiple Beam	14°	215'	215'	± 1°	± 30'	3	None	Annual on Tenders	1
P-220	x 2	3.5Mc, 200Mc	UN 954	UN 955	75	Linear	Electric	3 in	60°	200	± 3 in	± 5 in	± 1°	2	None	Ordinary	2
TR-993A	x 2	215Mc, 35Mc	UN 954	UN 955	120	Linear	Electric	12.5 in	214'	240'	± 150	± 20'	± 30'	2	Slight	Medium Frequency	3
TR 993A	x 2	215Mc, 35Mc	UN 954	UN 955	120	Linear	Electric	12.5 in	214'	240'	± 150	± 20'	± 30'	2	None	Medium Frequency	4
TR 1501	x 2	215Mc, 35Mc	UN 954	UN 955	120	Linear	Electric	12.5 in	214'	240'	± 150	± 20'	± 30'	2	None	Medium Frequency	5
TR 1501	x 2	215Mc, 35Mc	UN 954	UN 955	75	Linear	Optical	12.5 in	214'	240'	± 150	± 20'	± 30'	2	None	Medium Frequency	6
TR 1501	x 2	215Mc, 35Mc	UN 954	UN 955	75	Linear	Optical	12.5 in	214'	240'	± 150	± 20'	± 30'	2	None	Medium Frequency	7
T-311	x 2	14.5Mc	UN 954	UN 955	75	Linear	Optical	12.5 in	214'	240'	± 150	± 20'	± 30'	2	None	Medium Frequency	8
T-311	x 2	215Mc, 35Mc	UN 954	UN 955	75	Linear	Optical	12.5 in	214'	240'	± 150	± 20'	± 30'	2	None	Medium Frequency	9
T-310	x 2	215Mc, 35Mc	UN 954	UN 955	120	Linear	Electric	12.5 in	214'	240'	± 150	± 20'	± 30'	2	None	Medium Frequency	10
T-310	x 2	215Mc, 35Mc	UN 954	UN 955	120	Linear	Electric	12.5 in	214'	240'	± 150	± 20'	± 30'	2	None	Medium Frequency	11
T-310	x 2	215Mc, 35Mc	UN 954	UN 955	75	Linear	Optical	12.5 in	214'	240'	± 150	± 20'	± 30'	2	None	Medium Frequency	12
T-311	x 2	14.5Mc	UN 954	UN 955	75	Linear	Optical	12.5 in	214'	240'	± 150	± 20'	± 30'	2	None	Medium Frequency	13
TA 1504	x 2	15Mc	UN 954	UN 955	75	Linear	Optical	12.5 in	214'	240'	± 150	± 20'	± 30'	2	None	Medium Frequency	14
TA 1504	x 4	15Mc	UN 954	UN 955	75	Linear	Optical	12.5 in	214'	240'	± 150	± 20'	± 30'	2	None	Medium Frequency	15
TA 1504	x 4	15Mc	UN 954	UN 955	75	Linear	Optical	12.5 in	214'	240'	± 150	± 20'	± 30'	2	None	Medium Frequency	16
TA 1504	x 4	14.5Mc	UN 954	UN 955	75	Linear	Optical	12.5 in	214'	240'	± 150	± 20'	± 30'	2	None	Medium Frequency	17
T-321	x 2	215Mc, 35Mc	2400	UN 958	75	Linear	Optical	12.5 in	214'	240'	± 150	± 20'	± 30'	2	None	Medium Frequency	18
RT 326	x 2	205Mc, 8.5Mc	2400	UN 958	75	Linear	Optical	12.5 in	214'	240'	± 150	± 20'	± 30'	2	None	Medium Frequency	19
T-311	x 2	14.5Mc	UN 954	UN 955	75	Linear	Optical	12.5 in	214'	240'	± 150	± 20'	± 30'	2	None	Medium Frequency	20
T-311	x 2	215Mc, 35Mc	UN 954	UN 955	75	Linear	Optical	12.5 in	214'	240'	± 150	± 20'	± 30'	2	None	Medium Frequency	21
TA 1504	x 4	15Mc	UN 954	UN 955	75	Linear	Optical	12.5 in	214'	240'	± 150	± 20'	± 30'	2	None	Medium Frequency	22
																	23
																	24
																	25

Transmitter Ion Circuit/Oscillator Valve	Receiver Detector	Local Oscillator	Scale Representation Dial Swinging Axis	Scale	Antenna Type	Beam Angle Horizontal Vertical	Max. Range Miles Nautical Miles Feet	Min. Distance	Accuracy of Range	Distance Determination	Accuracy of Bearing	Angle of Observation	Spare Parts	No. of Operators	Degree of Operating Difficulty	Maintenance	No.
Unit T 311 +2 14.5Mc	UN 95A	UN 95S 75	Linear	Mechanical	2 x 4 Horizontal	12.4°	1.34	1775	1.34	1.34	1.34	1.34			None	Free Trouble	1
Unit T 311 +2 14.5Mc	UN 95A	UN 95S 75	Linear	Mechanical	Single Vertical	3.24	1607	1.34	1.34	1.34	1.34	1.34			None	Antenna System per Radio	2
Unit T 311 +2 14.5Mc	UN 95A	UN 95S 75	Linear	Mechanical	Vee Horizontal	7.4°	1.34	1775	1.34	1.34	1.34	1.34	Number of Spare Parts	2	None	Antenna System per Radio	3
Unit T 311 +2 14.5Mc	UN 95A	UN 95S 75	Linear	Mechanical	2 x 4 Horizontal	12.4°	1.34	1775	1.34	1.34	1.34	1.34	in Use + 5	5	None	Antenna System per Radio	4
Unit T 310 +2 215Mc 35Mc	UN 95A	UN 95S 120	Linear	Electric	6 x 2 Horizontal	14.4°	1.17	2467	1.17	1.17	1.17	1.17	Number of Spare Parts	2	None	Antenna System per Radio	5
Unit T 310 +2 215Mc 35Mc	UN 95A	UN 95S 120	Linear	Electric	4 x 2 Horizontal	12.4°	1.17	2467	1.17	1.17	1.17	1.17	in Use + 5	5	None	Antenna System per Radio	6
Unit T 310 +2 215Mc 35Mc	UN 95A	UN 95S 120	Linear	Electric	4 x 3 Horizontal	14.4°	1.17	2467	1.17	1.17	1.17	1.17	Number of Spare Parts	2	None	Antenna System per Radio	7
Unit T 311 +2 215Mc 35Mc	UN 95A	UN 95S 75	Linear	Optical Electric	4 x 3 Horizontal	14.4°	1.17	1775	1.17	1.17	1.17	1.17	in Use + 5	5	Difficult	Antenna System per Radio	8
Unit T 311 +2 215Mc 35Mc	UN 95A	UN 95S 120	Linear	Electric	4 x 4 Horizontal	15.4°	1.17	2467	1.17	1.17	1.17	1.17		2	Difficult	Antenna System per Radio	9
Unit T 311 +2 215Mc 35Mc	UN 95A	UN 95S 120	Linear	Electric	4 x 4 Horizontal	15.4°	1.17	2467	1.17	1.17	1.17	1.17		2	Difficult	Antenna System per Radio	10
Unit SN 7 +2 215Mc 35Mc	2400	UN 95S 120	Curve	Mechanical	2 x 4 Horizontal	12.4°	1.25	1775	1.25	1.25	1.25	1.25	Number of Spare Parts	2	None	Antenna System per Radio	11
Unit T 311 +2 215Mc 35Mc	2400	UN 95S 75	Linear	Linear	2 x 4 Horizontal	12.4°	1.25	1775	1.25	1.25	1.25	1.25		2	None	Antenna System per Radio	12
Unit T 311 +2 215Mc 35Mc	2400	UN 95S 75	Linear	Linear	2 x 4 Horizontal	12.4°	1.25	1775	1.25	1.25	1.25	1.25		2	None	Antenna System per Radio	13
Unit T 311 +2 215Mc 35Mc	2400	UN 95S 75	Linear	Linear	2 x 4 Horizontal	12.4°	1.25	1775	1.25	1.25	1.25	1.25		2	None	Antenna System per Radio	14
Unit T 311 +2 215Mc 35Mc	2400	UN 95S 75	Linear	Linear	2 x 4 Horizontal	12.4°	1.25	1775	1.25	1.25	1.25	1.25		2	None	Antenna System per Radio	15
Unit M 312 B	14 x 1Mc	Crystal	LD 1	75	Linear	Horizontal	15.4°	1.17	2467	1.17	1.17	1.17	Number of Spare Parts	2	None	Antenna System per Radio	16
Unit M 312 A	14 x 1Mc	Crystal	LD 1	75	Linear	Horizontal	15.4°	1.17	2467	1.17	1.17	1.17	Number of Spare Parts	2	None	Antenna System per Radio	17
Unit M 312 A	14 x 1Mc	Crystal	LD 1	75	Linear	Horizontal	15.4°	1.17	2467	1.17	1.17	1.17	Number of Spare Parts	2	None	Antenna System per Radio	18
Unit M 312 A	14 x 1Mc	Crystal	LD 1	75	Linear	Horizontal	15.4°	1.17	2467	1.17	1.17	1.17	Number of Spare Parts	2	None	Antenna System per Radio	19
Unit M 312 A	14 x 1Mc	Crystal	LD 1	75	Linear	Horizontal	15.4°	1.17	2467	1.17	1.17	1.17	Number of Spare Parts	2	None	Antenna System per Radio	20
																	21
																	22

[illegible][illegible]

RADAR NO. 11

ANTI-AIR WARNING

Corresponding Allied Designation: Mark 1 Model 1 Modifications 1 and 2.

Technical Characteristics:

f = 100 MC/S. 40 KW. 200 Km.

Accuracy: Range, + 1-2 Km; Azimuth, + 2-3°.

Number Built = 80.

Number Installed = Many

Description:

Radar No. 11, which is the navy's abbreviation for Mark 1 Model 1, was the first of the Japanese radars to be seen by American forces. Early types were captured at Guadalcanal and in the Aleutians. Research was begun on it in April 1941 and completed a year later. It corresponds in Japanese radar history to the SCR-270 in American. Quite a number of them were standing guard on Honshu and Kyushu shores awaiting the anticipated invasion of late 1945.

This set is a straightforward 100 MC/S radar, using a 15 kc sine wave base oscillator with demultipliers to establish the prf of 1000. A pair of large transmitting triodes (TR-1501) is used to obtain a 40 kw peak power output in the later models. Display is on a 120 mm A-tube with 0-300 km range scale.

As with many of the Japanese radars, the house containing the equipment supports the antenna mattress array and rotates with it on a circular track. Short transmission lines are obtained by this means as well as no need for troublesome rotary joints. The antenna itself for the 11-2 and 11-3 models as shown in the block diagram is in two parts, the left half a 3 x 4 array for receiving and the right a 2 x 4 array for transmitting. The dipoles are mounted $\frac{1}{4}$ distance in front of the wire mesh reflector.

No. 11 is a very large and cumbersome set primarily designed for fixed installations and although it gave an excellent account of itself, the Japanese found it necessary to develop a number of lighter and more readily portable sets for their needs in island to island hopping in the south and southwest Pacific expansions. These are described in the following pages.

Accuracy : $\pm 1 \sim 2 \text{ km}$

Transmitting Antenna
(Dix 10th pipe)

Horizontal Pattern

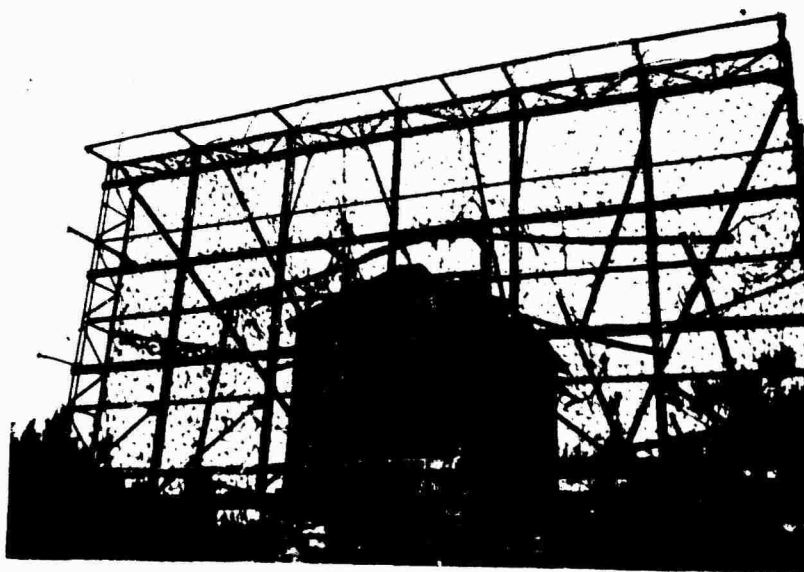
Receiving Antenna Transmitting Antenna



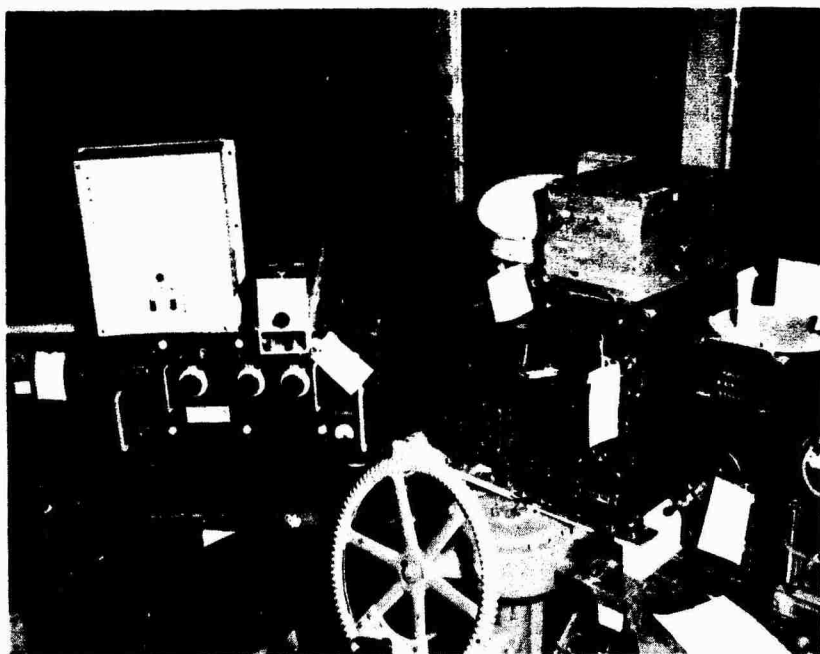
↑↑↑ Ac 2200 64 04 12



Type 11 Early Warning Radar with a Commanding View at Chigasaki.



A Rope Netting Helps Camouflage this Type 11 Antenna at Chigasaki.



Type 11 Set (Type II, Mk 1 Model 1 Modif 3)
Showing Operator's Table.



Transmitter
of Type 11
Used Two
Paralleled
Triodes
No. TR-1504



Receiver
and
Indicator
of Type 11

Handwheel
or Motor
Turning
of the
Antenna
is Possible.

RADAR NO. 12

PORTABLE ANTI-AIR WARNING

Corresponding Allied Designation: Mark 1 Model 2.

Technical Characteristics:

$f = 200 \text{ MC/S}$. 5 KW. Range 100 km.
Accuracy: Range, $\pm 1-2 \text{ km}$; Azimuth, $\pm 5^\circ$.

Number Built = ? Number Installed = Many

Description:

Radar No. 12 was developed as the first portable set to use in place of the bulky No. 11. Raising the frequency to 200 MC/S greatly reduced the antenna size as seen on the photographs (to about 14' x 7'). The transmitting antenna was placed in the upper bay and an identical receiving antenna in the lower bay. In this manner a quite narrow beam of 22° was projected, less than half that of the No. 11 set. The power output, however, was only 5 kw. Operations people report that this set was one of the least satisfactory of their warning radars with frequent breakdowns and an unstable transmitter frequency. Nevertheless many were seen in the Solomons, New Guinea and the Netherlands East Indies, with a few even on the Japanese home islands as standby equipments.

The circuits and display of the target information follow closely those of No. 11.

It should be noted that the later sets labelled No. 12-Kai (or Modification)-2 and 12-Kai-3 are at a lower frequency (150 MC/S) and have quite different antenna structures. In the frequently seen Kai-3 for instance two of the triangular girders used as antennas for Radar No. 13 are mounted side by side at the rear edge of the revolving cabin's roof; one carries the 2 x 4 transmitting antenna and the other a 2 x 4 receiving antenna. Photos of this set are also shown below.

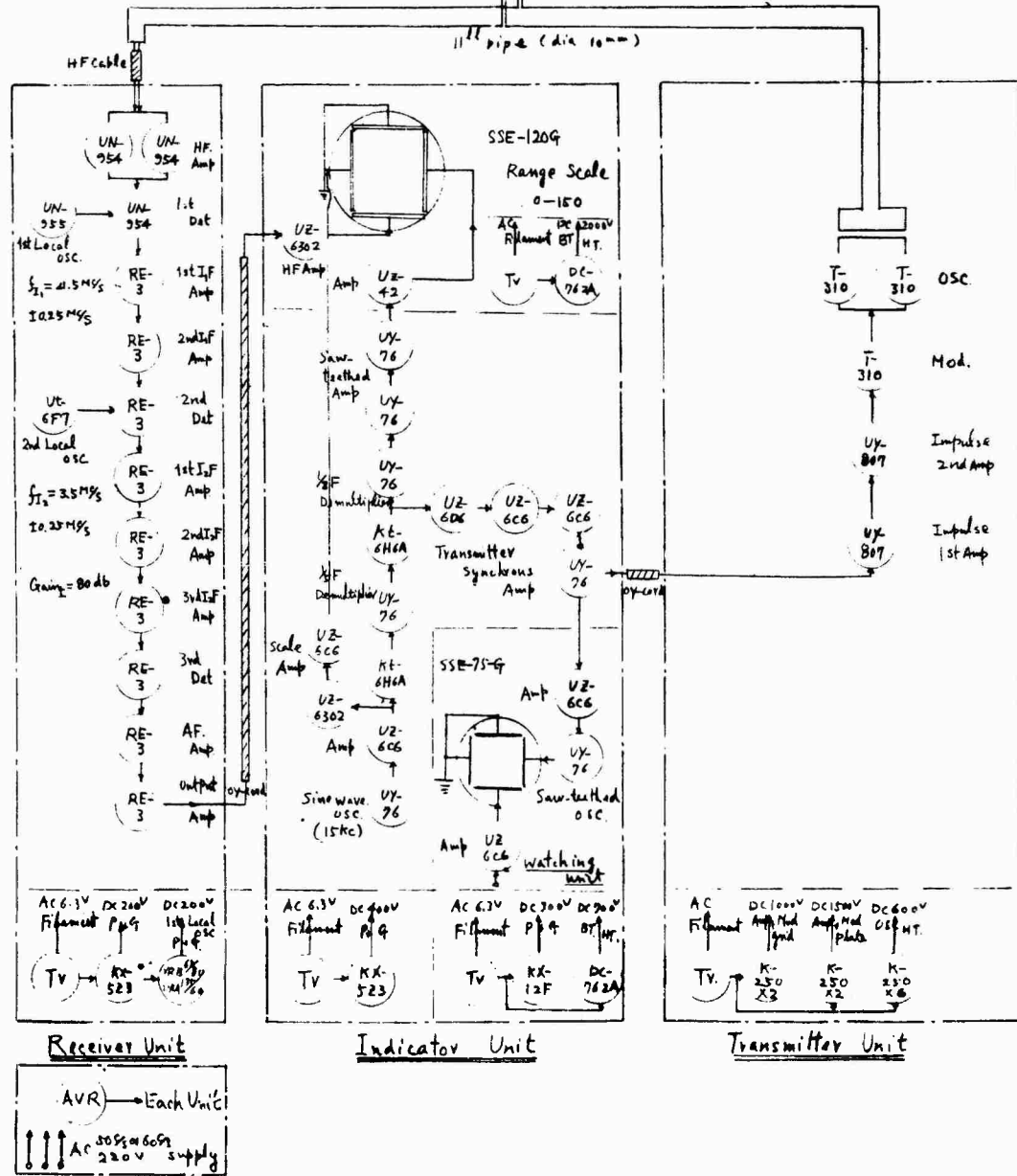
Radar Type 12

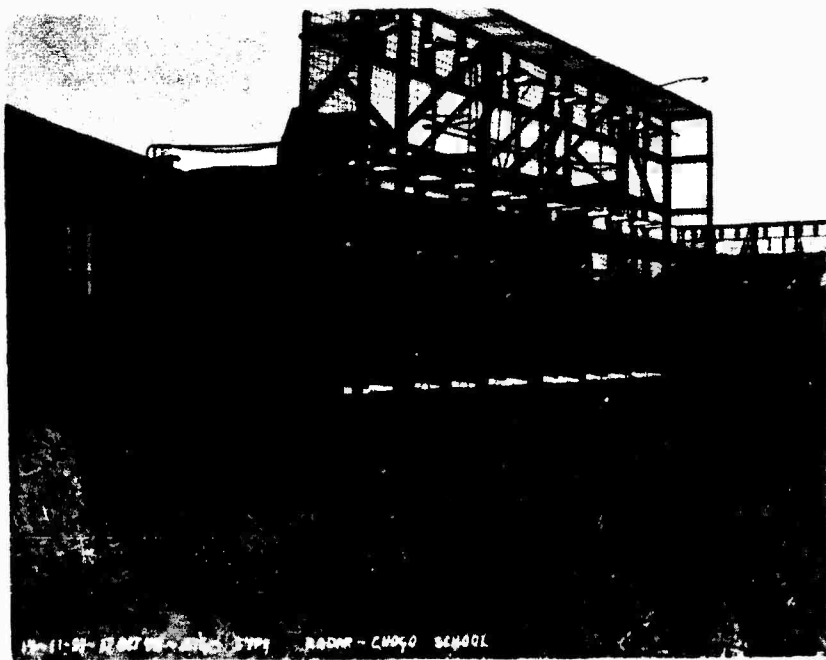
For Land Use.
 Output Power : 5 kw.
 Frequency : 200 Mc.
 Pulse Length : 10 μ s.
 Range : 100 km.
 Accuracy : $\pm 1-2$ km. Reflector Dia 3" - steel Net mesh 4" x 4" - Projector Dia 10" - Pipe

Transmitting Antenna

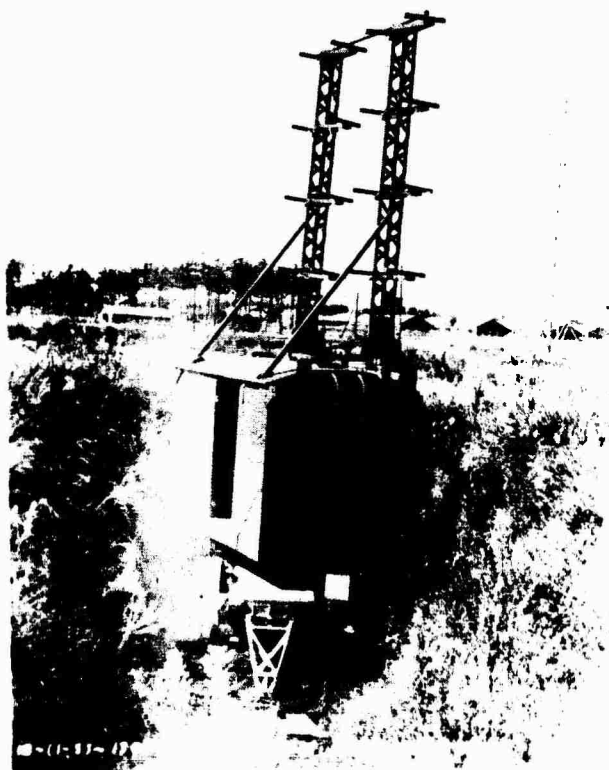
Horizontal Pattern

Receiving Antenna

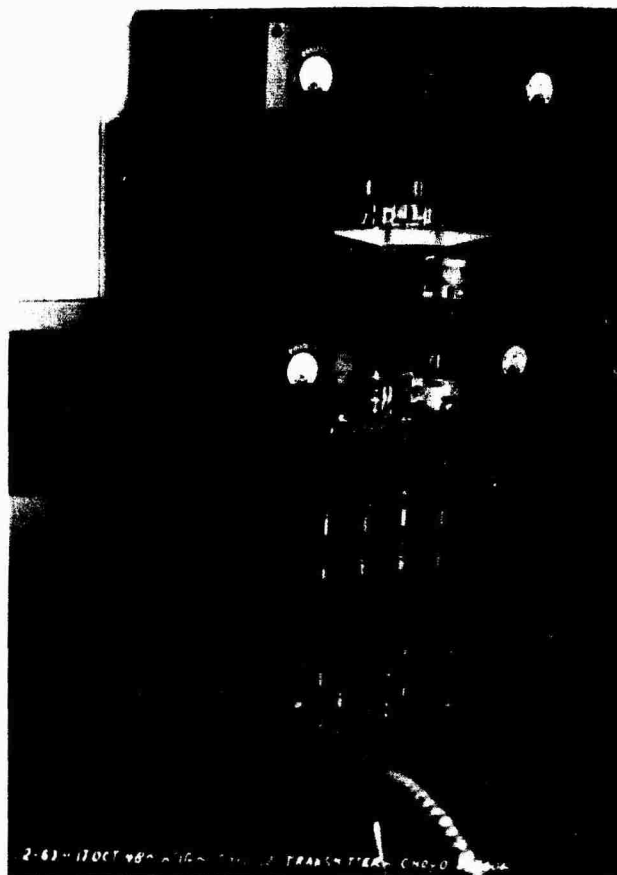




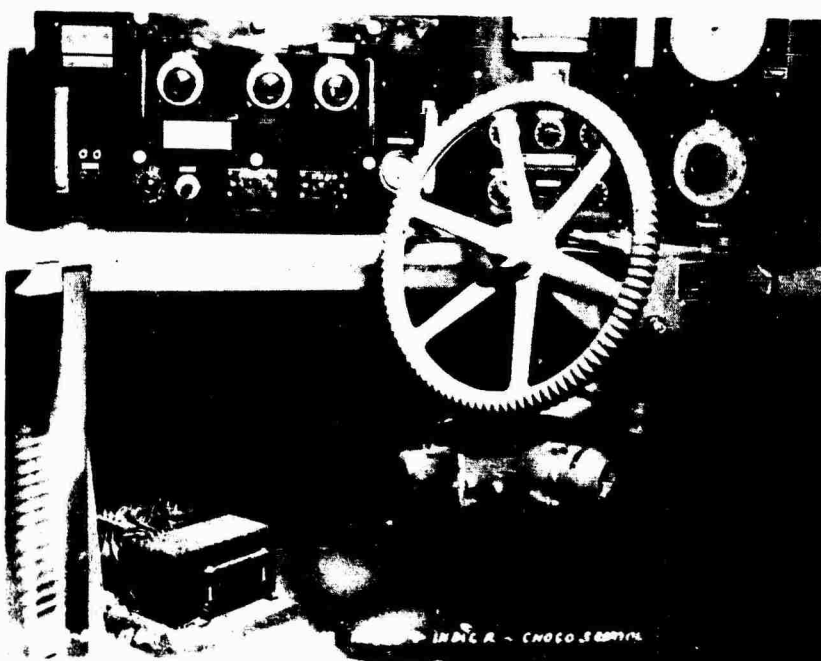
Type 12 Portable Early Warning Radar --
Original Design at 200 MC--Chogo.



Later Version
(Modification 3)
of Type 12 Port-
able Radar which
works at 150 MC
Chogo.



Transmitter
for
Type 12,
Modification 3
(200 MC).



Receiver and Indicator for Type 12 Sets.

RADAR NO. 13

SMALL SIZE ANTI-AIR WARNING - FOR LAND, SHIPS, AND SUBMARINES

Corresponding Allied Designation: Mark 1 Model 3.

Technical Characteristics:

$f = 150 \text{ MC/S}$. 10 KW. Range 100 Km.
Accuracy: Range, $\pm 2-3 \text{ Km}$; Azimuth, $\pm 10^\circ$.

Number Built = 1500. Number Installed = Many

Description:

This is a small sized land radar operating at 150 MC/S which found wide use throughout the Pacific islands where a light and easily transported equipment was needed. In many land installations a single triangular cross-section girder was erected carrying a 2 x 4 element array backed by an identical reflector array. (This is one-half of the antenna used in the No. 12-Kai-3 set seen on a previous page.) For installation on a ship or small vessel the more rugged mechanical construction shown in one of the photos below is used. This is also suitable for land installations.

A very elementary circuit is used, the transmitter being pulsed by a 500 cps sine wave oscillator. A single A-type display has scales reading 0-150 km and 150-300 km. Since a single antenna is used for both transmitting and receiving a gas discharge "valve" is placed across the receiver transmission line to protect that unit from the heavy transmitter pulse. The antenna azimuth is indicated to the operator by a servo driven dial at the set.

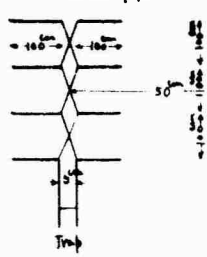
The No. 13 sets were considered highly satisfactory by operating personnel.

Radar Model 3-13

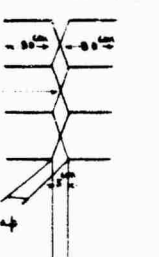
For Land, Ship
+ Submarine Use

Power Output : 10 kw
Frequency : 150 Mcp
Pulse Length: 10 μ s
Range : 100 km
Accuracy : $\pm 2-3$ km

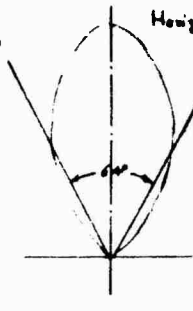
Reflector
(10" dia pipe)



Projector
(10" dia pipe)



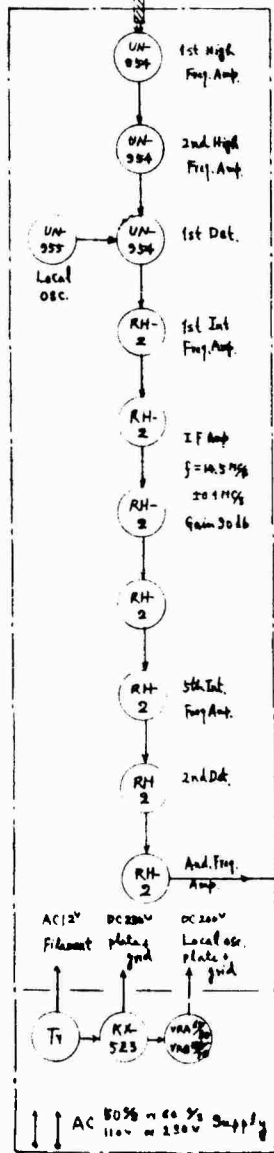
Horizontal Pattern



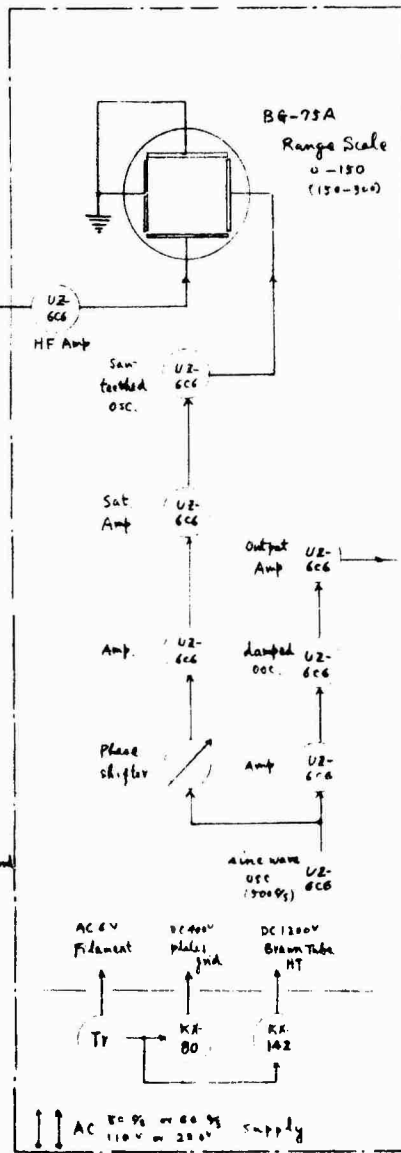
HF cable

Discharge
valves
B-1

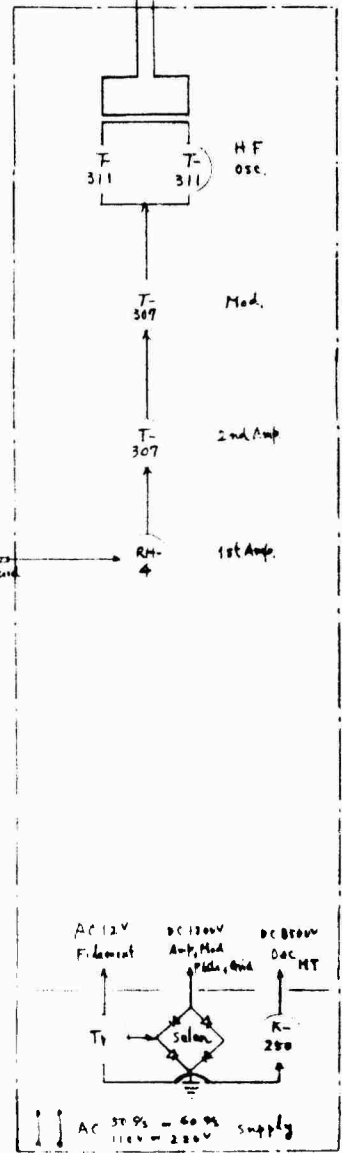
11 ft wire (No. 10-11)



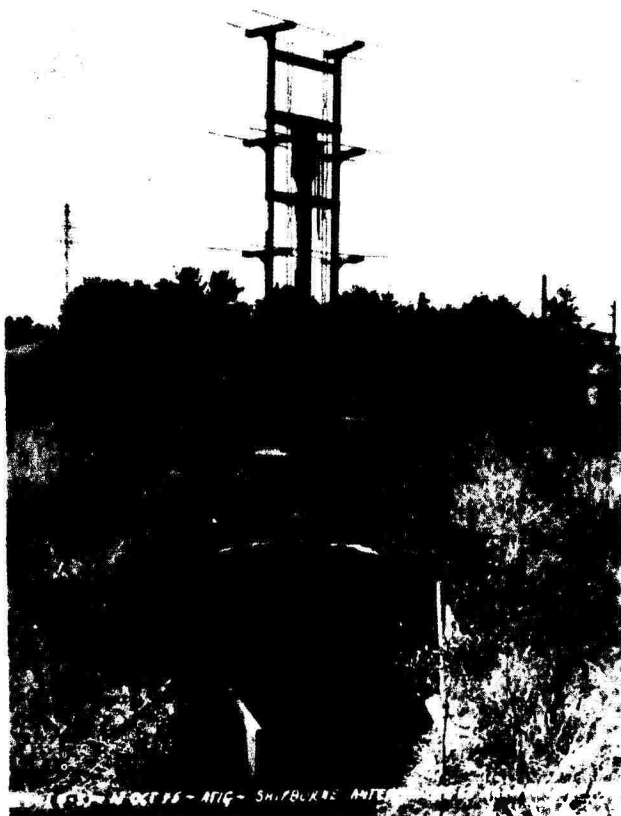
Receiver Unit



Indicator Unit

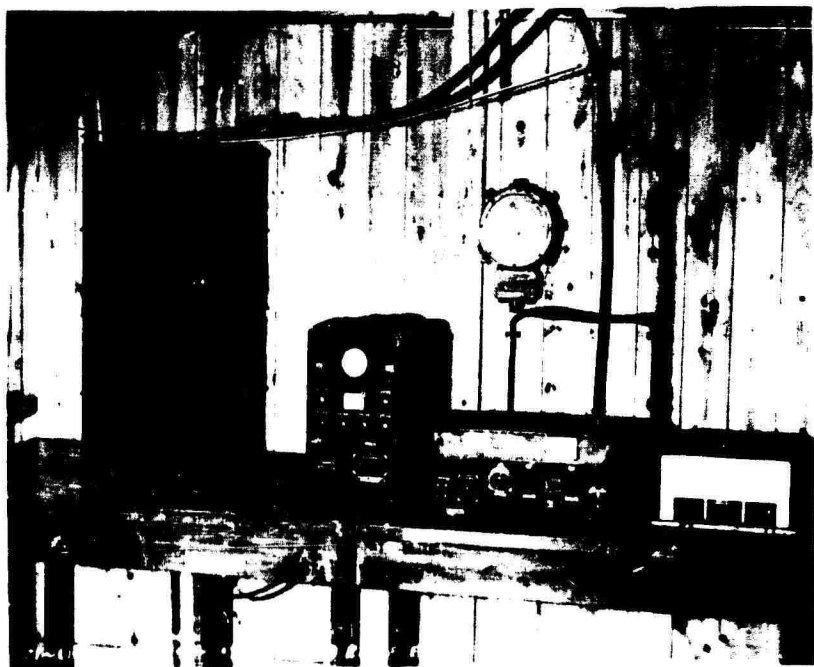


Transmitter Unit



A Type 13
Antenna
Suited for
Ship Installation.

(For land commonly use one
triangular cross-section girder
for support).
(Chogo)



Type 13 Equipment - Note Small
Size of Components.



Type 13 Equipment with Covers Removed.

RADAR NO. 11K

MEDIUM SIZE ANTI-AIR WARNING - LAND BASED

Corresponding Allied Designation: Type 3 Mark 1 Model 1.

Technical Characteristics:

f = 150 MC/S. 10 KW. Range, 150 km.

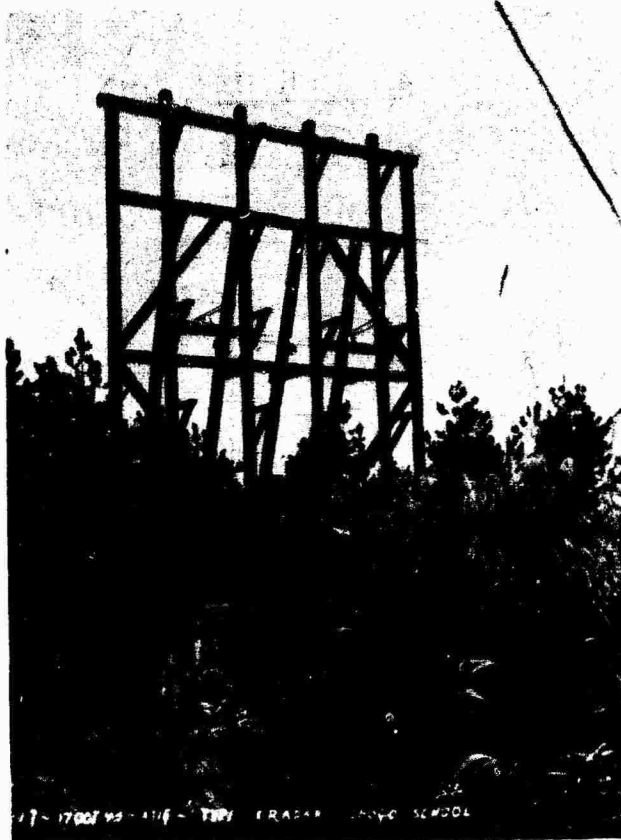
Accuracy: Range, \pm 2-3 km; Azimuth, \pm 5°.

Number Built = 50 (?) Number Installed = Few

Description:

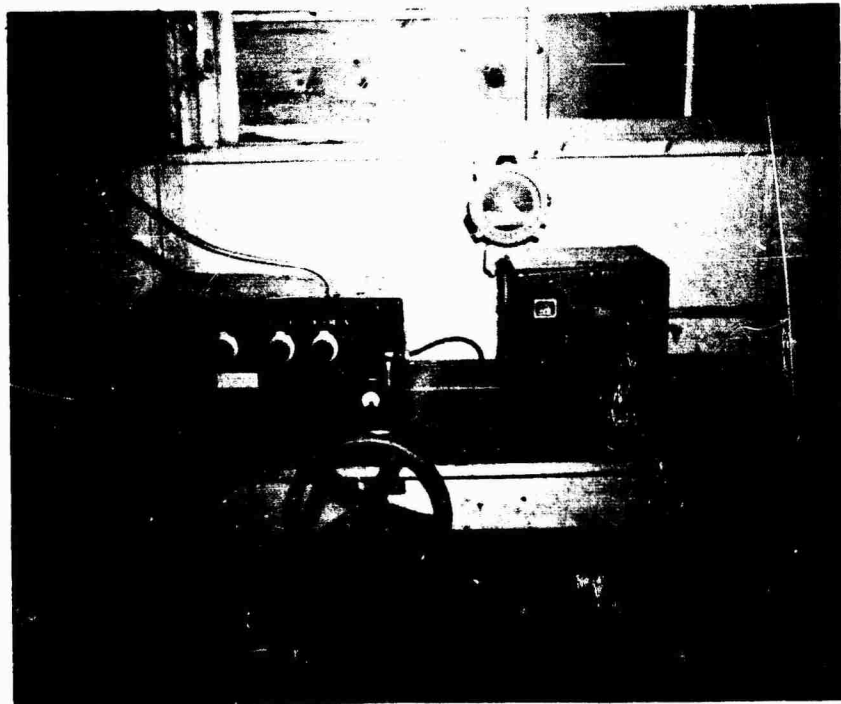
Radar 11K was a relatively recent attempt to solve the aircraft warning problem at locations where the large No. 11 radar could not readily be installed, and yet give better range than either the No. 12 or 13 sets. It was designed for easy installation and mass production. However, it got into the field fairly late and not too many were installed by the time the war ended. Several were used in the Nansei Shoto islands (Okinawa group) including one at Minami Daito Shima.

The components are principally drawn from those used in other sets, No. 12 contributing the transmitter (with higher power tubes) and the receiver.



Model 11 k
(Model 11 Simpli-
fied)

Chogo



Receiver and Indicator for Type 11k.



Test Equipment and Azimuth
Indicator for Type 11k Radar.

RADIO DETECTOR NO. 14

LONG RANGE ANTI-AIR WARNING

Corresponding Allied Designation: ----

Technical Characteristics:

$f = 50 \text{ MC/S.}$ 100 KW. Range 450 Km.

Accuracy: Range $\pm 5 \text{ Km}$; Azimuth, $\pm 3-4^\circ$.

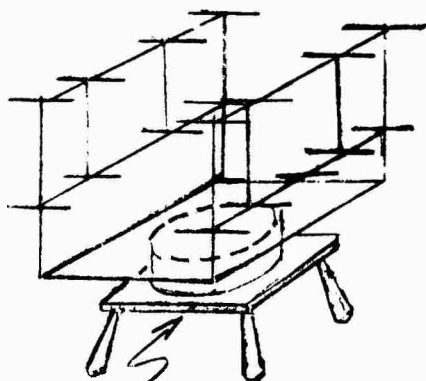
Number Built = 20 planned, 7 built.

Number Installed = 3.

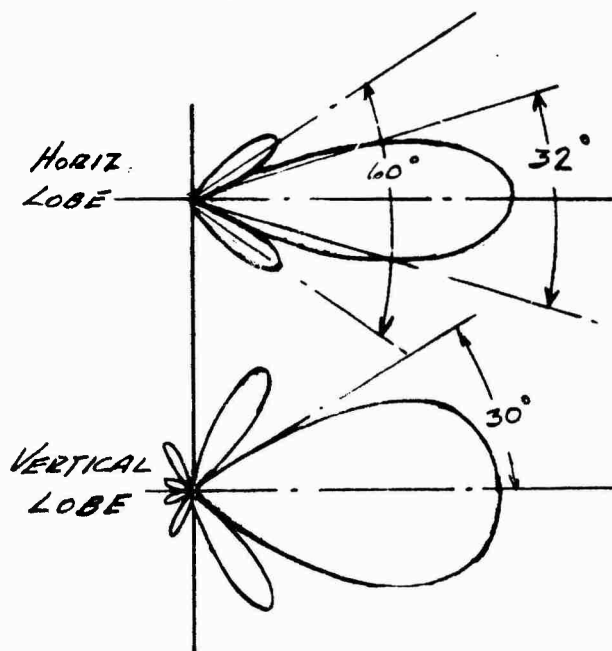
Description:

During the winter of 1944-45 the B-29 raids on the Japanese homeland began to mount in intensity. The navy was unable to pick them up consistently at long distances. A new long wave (6 meter), very high power (100 kw) set was quickly designed, Feb to May 1945, and the first equipments were crash manufactured by Tokyo Shibaura in 3 weeks! One set was installed at Cape Iro-Zaki near Shimoda, another at Toi-misaki on the very southeast tip of Kyushu and a third at Shionomisake near Osaka. Detection of approaching B-29s at distances greater than 300 km was reported.

The antenna is a large rotatable structure bearing an array of 2 Yagi antennas. Below is given a rough sketch of its construction. There is no rotary r.f. joint, a fixed cable being used, so antenna is swung back and forth at a rate of 180° per minute but does not rotate. Very simple circuits were used, the display being A-type on a 120 mm cathode ray tube. Range is accurately determined by means of a series of marker pips dropping below the scope's base line. Prf was set by a 250 cps master oscillator.



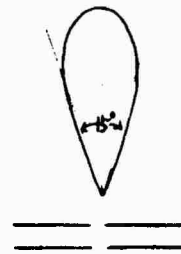
USES No. 11
SET'S TURNABLE



Radio Detector No. 14

for Long Range

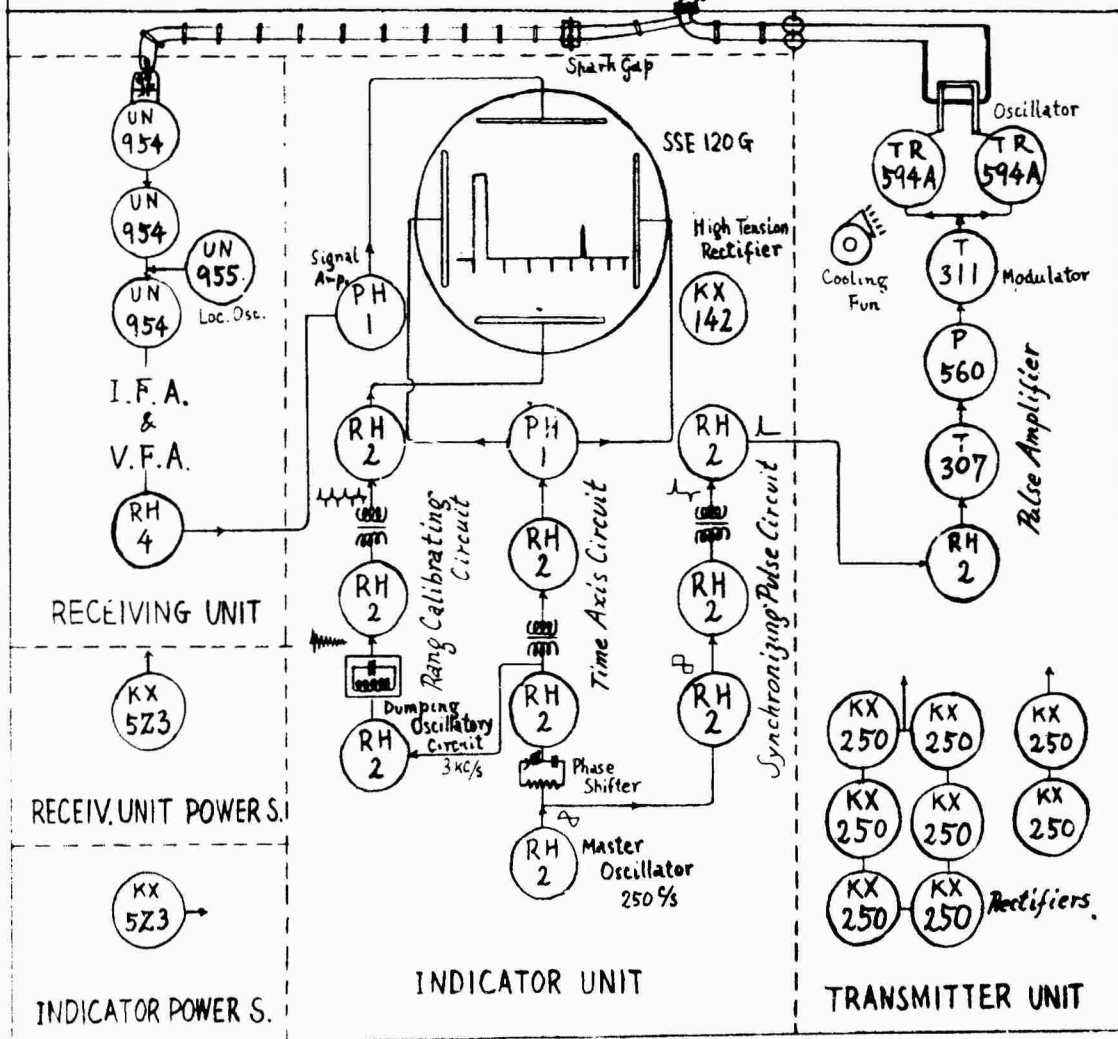
Power Output ; 100 KW
Pulse Length ; 20 μ -sec
Range ; 450 Km
Accuracy { Bearing $\pm 3 \sim 4^\circ$
Range ± 5 Km



$\lambda = 6$ m

ANTENNA EQUIPMENT

Antenna Gain ; 14 db



RADAR NO. 21

ANTI-AIR WARNING - SHIPBORNE

Corresponding Allied Designation: Mark 4 Model 2, several modifications.

Technical Characteristics:

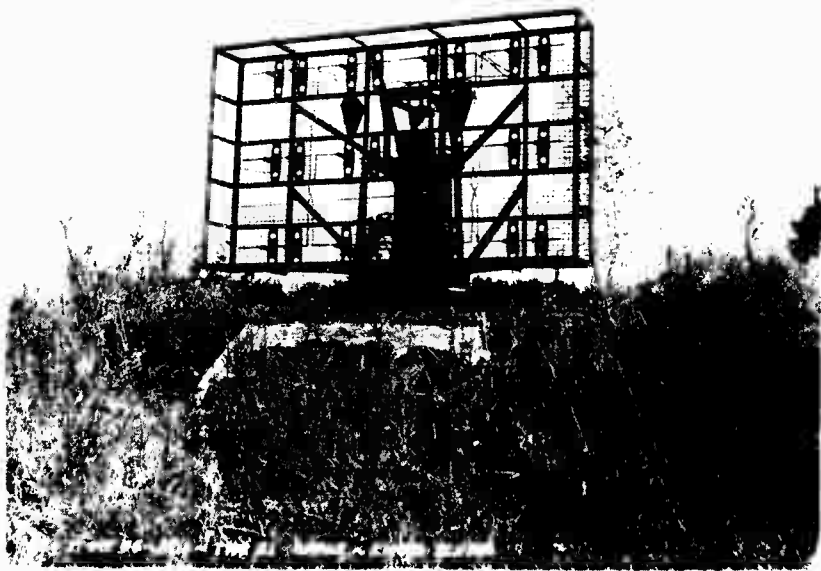
f = 200 MC/S. 5 KW. Range, 100 km.
Accuracy: Range, + 1-2 km; Azimuth, + 5°.

Number Built = 250 (?)

Number Installed = ?

Description:

The 21 set utilizes the same equipment as the No. 12 200 MC/S set originally built for land use, but with a different antenna. Several antennas were used, the last one on Kai (Modification)-2 being shown in the photo below. This antenna is small and rugged and is designed to be installed on the top of the ships foremast.



Type 21 Antenna for Ship Installation.

For Ship use

Frequency = 200 MHz.

Pulse Length: 10 μ s

Range 2400 km.

Accuracy : ± 2 km. Reflector Dia 3mm Steel Net
mesh 40mm x 40mm

Projector · Dia 10" Pipe

11th pipe (dia 10 mm)

Indicator	Unit
-----------	------

Transmitter Unit

(AVR) → Each Unit

AC 50% = 60% supply
220 V

RADAR NO. 22

ANTI-SURFACE WARNING FOR SHIP USE

Corresponding Allied Designation: Mark 2 Model 2, Modifications 2-3-4.

Technical Characteristics:

Wavelength = 10 cm. 2 KW. Range 25 Km against battleship.
Accuracy: Range, + 100-250 M; Azimuth, + 2-3°.

Number Built = 500. Number Installed = Large Number.

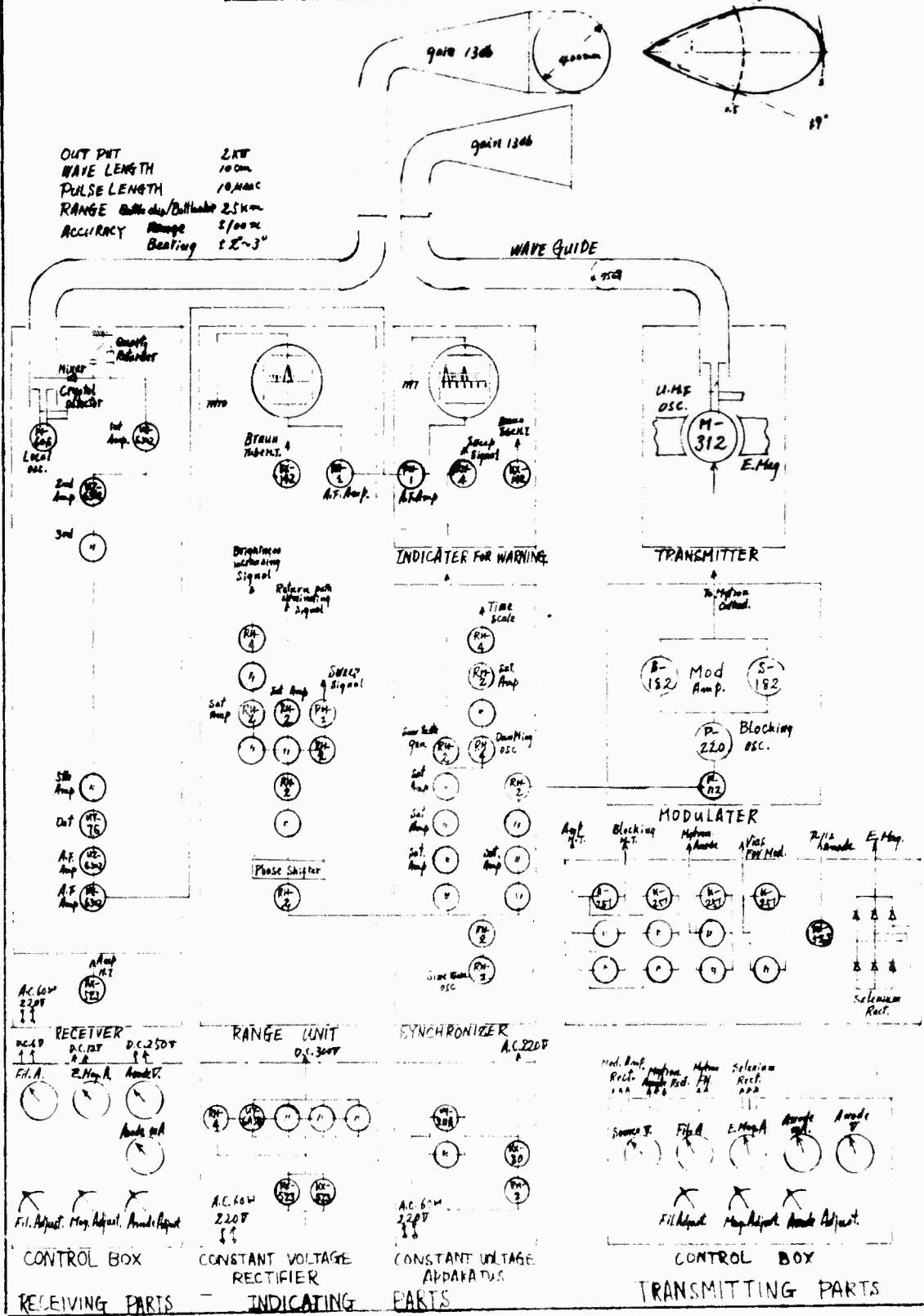
Description:

Shipborne warning radar No. 22 appears to have been one of the most satisfactory equipments used by the Japanese navy. Large numbers were installed. Research began on this 10 cm set in October 1941 and the equipment went through numerous modifications and improvements during the following 3 or 4 years. A pair of small horns, one for transmitting and one for receiving, and mounted to rotate on a base in such a way as to always point in the same direction at once, provide a simple and rugged antenna structure without need for the loss inherent in the T-R tube arrangement. The set is very heavy being comprised of more than a dozen components as follows:

Transmitter parts:	Transmitter Cooler Pulse Modulator Rectifier Control Box
Receiver parts:	Receiver Control Box
Indicator parts:	Synchronizer Range Unit Indicator for warning Rectifier
Radiator parts:	Wave guide Transmitting horn Receiving horn

The transmitter is powered by an W-312 magnetron, the anode being water cooled by a motor driven pump. Peak power is approximately 2 kw, with 11000 volts applied to the magnetron. A blocking oscillator provides the 10 microsecond keying pulse at a rate of 2500 per second controlled by a tuning fork. The receiver is a superheterodyne with crystal detector and magnetron M-60 local oscillator. The Intermediate Frequency is 14.5 mc, the total receiver gain amounting to 120 db.

TYPE 22



The display is on two Type A cathode ray tubes. One tube called the "Indicator for Warning" shows all target echoes up to 60 km, with range pips appearing every 5 km. A 3 microsecond range pulse is moved along as the range crank is turned. The second, or "Range Operator's", scope gives an expanded view of about 1000 meters of the range as selected by the range crank. A magnifying glass in front of the scope gives it a size equivalent to a 5" tube. The true range is read on a dial when the target pip's leading edge is set just even with a vertical line inscribed up the face of the scope.

Detailed Schematic diagrams of the No. 22 set are included in Appendix II.

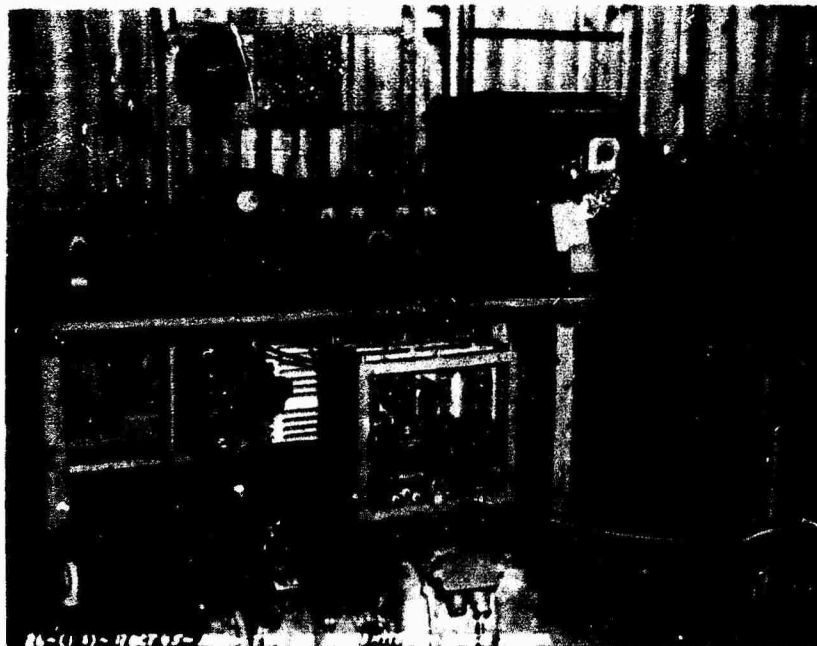
A somewhat simplified version of the No. 22 set called Modification-3 is installed on the conning tower of submarines; it uses two horns mounted side by side as shown in one of the photos below. Presentation is of the A-type on a single 75 mm scope. Range from a submarine is about 10 km on a battleship.



Row of No. 22 Shipborne sets Installed in Huts
for Training at Navy School--Chogo.



Synchronizer for Type 22 Radar.



Shipborne 10 cm Radar No. 22 for Surface Search.

Identification of Units:

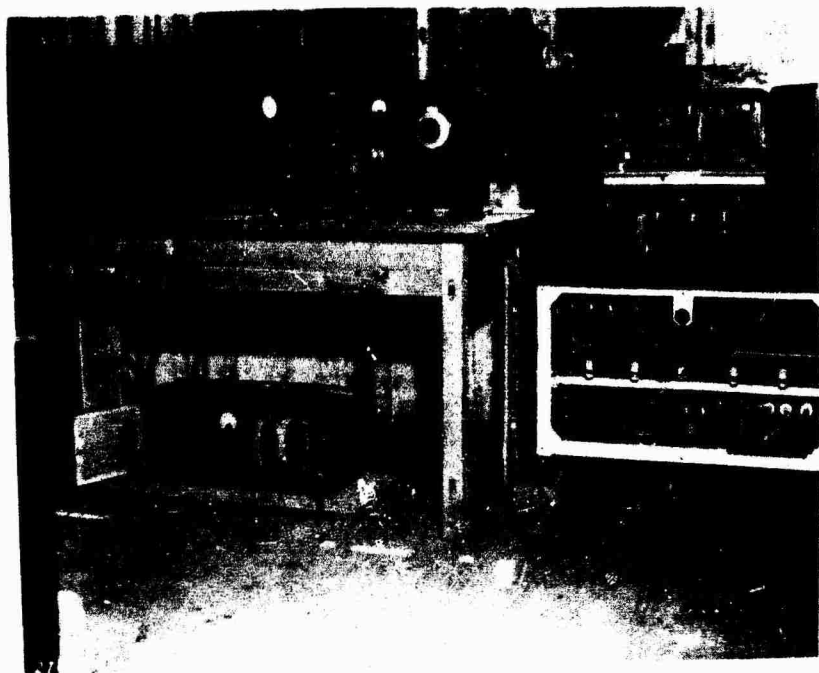
In foreground: Antenna turning motor.

Under bench, left to right: Antenna control handles,
Rectifier.

On bench, left to right: Receiver, Indicator for Warning,
Receiver control panel, Transmitter, Transmitter
Control Panel.

On wall: Antenna azimuth indicator.

(Remainder of No. 22 bench set up shown on next page)



Shipborne 10 cm Radar No. 22 Surface Search.

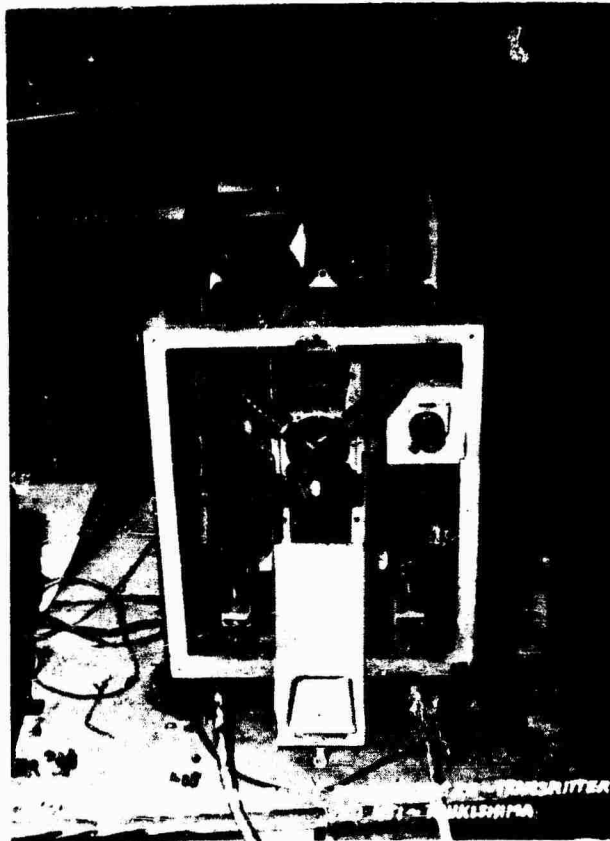
Identification of Units;

Under bench: Rectifier.

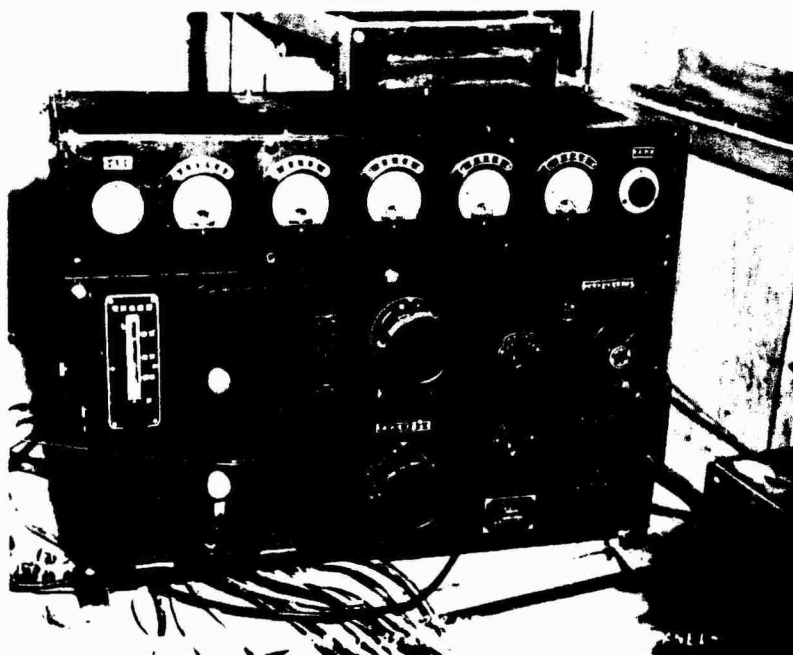
On Bench: Range Unit, Monitoring A-scope, Test Equipment.

To Right of Bench: Power Rectifier.

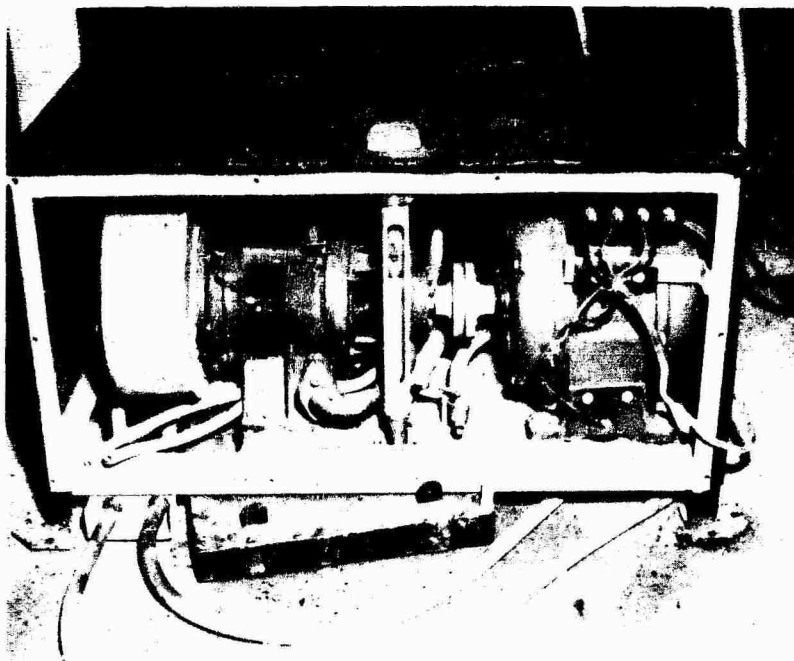
(Remainder of No. 22 bench set up shown on preceding page)



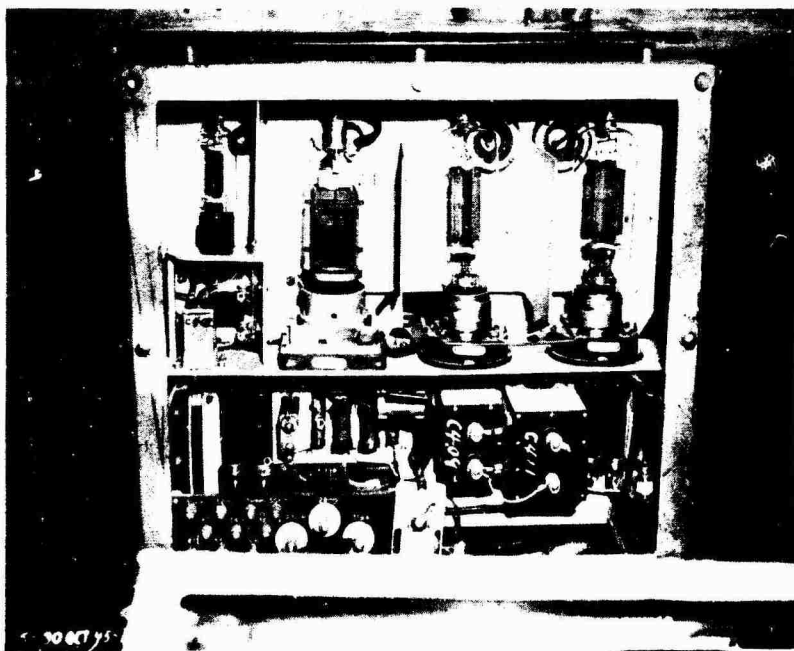
Transmitter
for No. 22
Radar,
Showing Rear
of Water
Cooled
Magnetron.



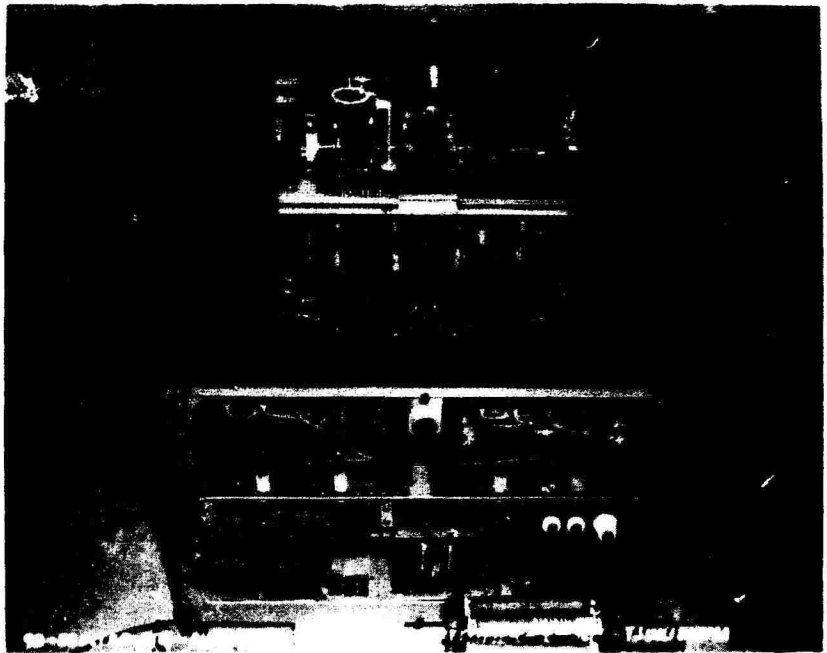
Transmitter Control Panel - Radar No. 22.



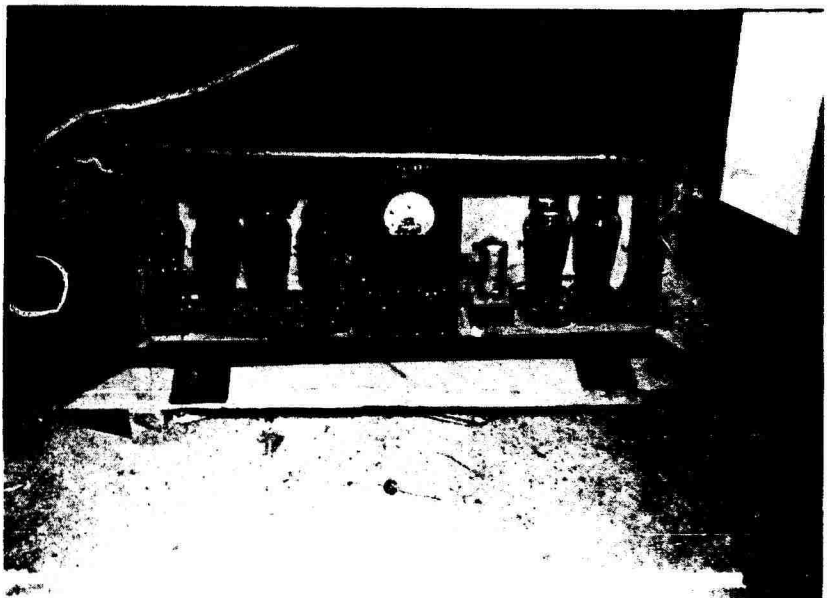
Cooling Water Pump for Magnetron.



Pulse Modulator - Type 22 Radar.



Power Rectifier for Type 22 Radar.



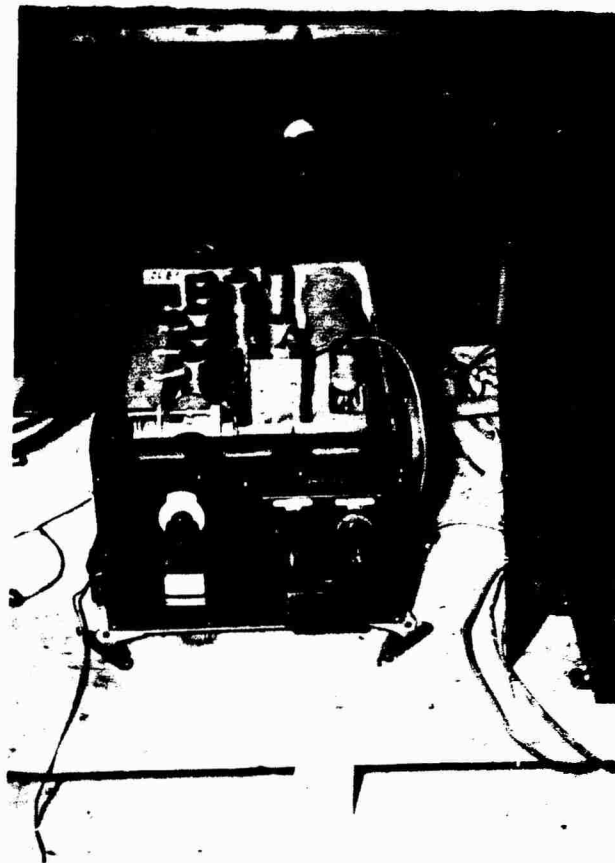
Rectifier for Receiver and Indicator - Type 22 Radar.



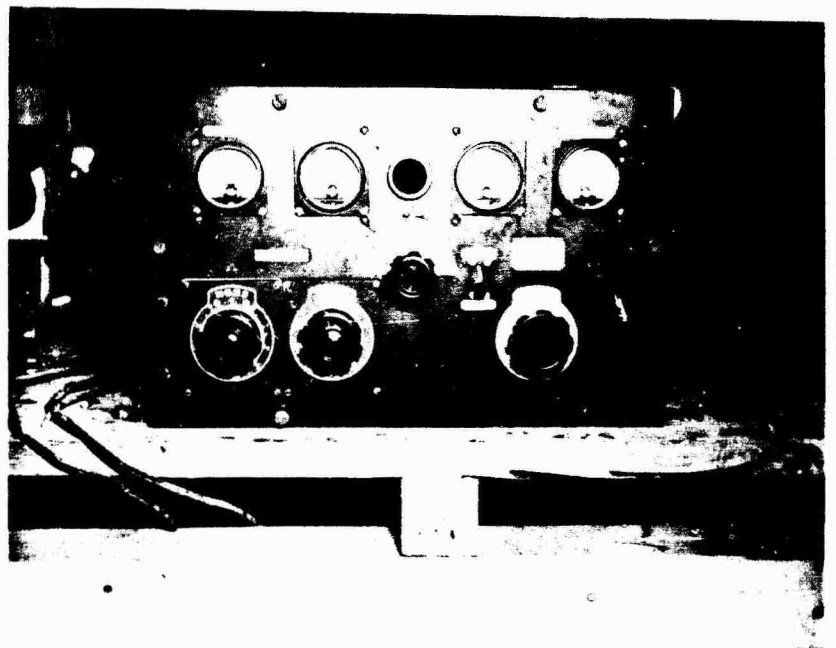
"Constant Voltage" Apparatus - No. 22 Radar.



Constant
Voltage
Control
Panel.



Receiver Unit
for Type 22
Radar.



Receiver Control Panel - Type 22 Radar.



Indicator
for
Warning

--
Type 22
Shipborne
Radar.

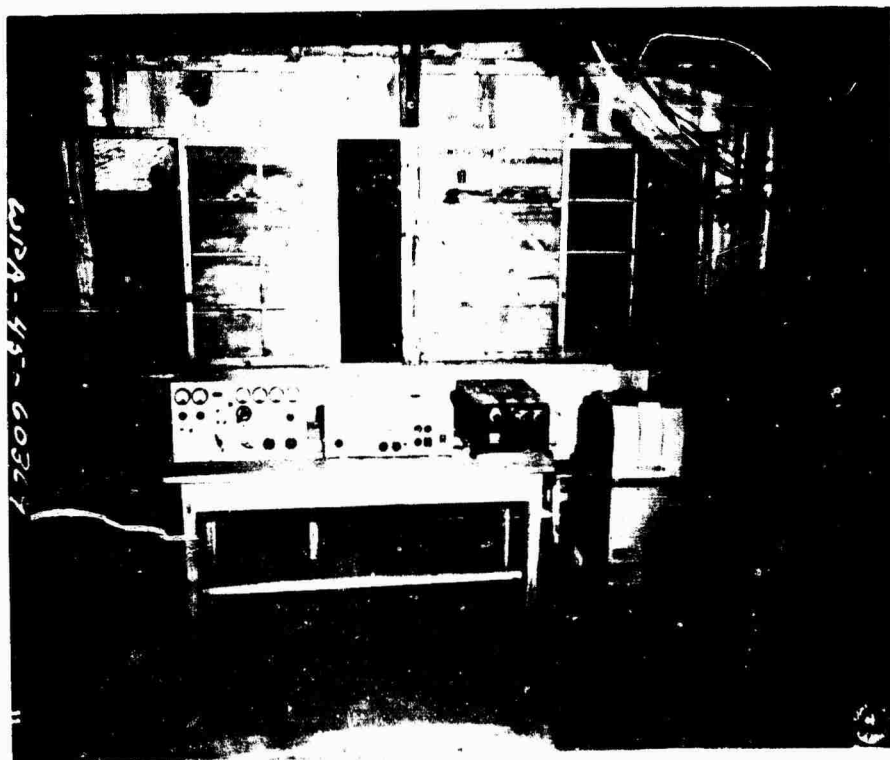
2ND NTI-TRUMISHIP
42-10 8795-AT-6-SHIPBORNE RADAR TYPE 22-INDIC FOR WARM



Range Unit - Type 22 Radar.



Antenna for
10 cm Radar
No. 22 - Kai-3
for Submarine
Installation.



No. 22 - Kai-3 Set for Submarine Use.

H-6

AIRBORNE PATROL AND SEARCH - LARGE PLANES

Corresponding Allied Designation: ----

Technical Characteristics:

f = 150 MC/S. 3 KW. Range 60 miles for a large ship.
Accuracy: Range, ± 5%; Azimuth, ± 3°.

Number Built = 2000+

Number Installed = Many

Description:

This was the first Japanese Navy airborne radar and, like the army's Taki-1, could use any one of three antennas at will, giving it both search and homing abilities. This equipment gave very satisfactory search service as long as high definition was unnecessary.

Block Diagram
of the Radiodetector
type of the "H-6"

H-6

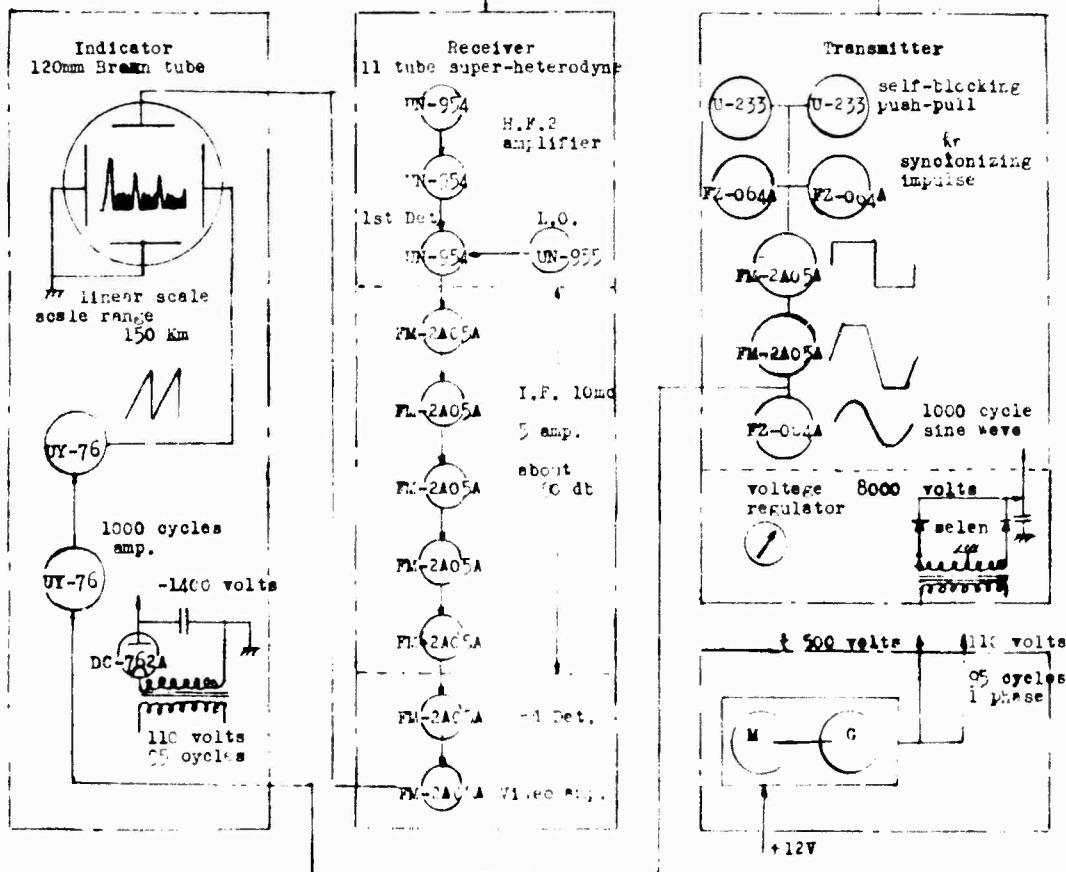
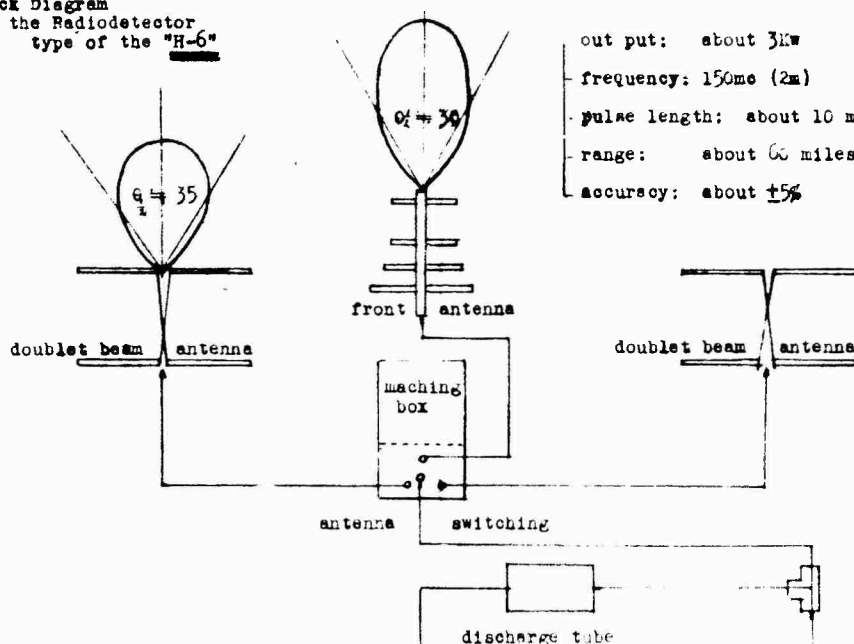
out put: about 3Kw

frequency: 150mc (2m)

pulse length: about 10 mic. second

range: about 60 miles for a big ship

accuracy: about $\pm 5\%$



FK-3

PATROL AND SEARCH - SMALL PLANES

Corresponding Allied Designation: ----

Technical Characteristics:

f = 150 MC/S. 2 KW. Range 30 miles against a large ship.
Accuracy: Range $\pm 5\%$; Azimuth, $\pm 3^\circ$.

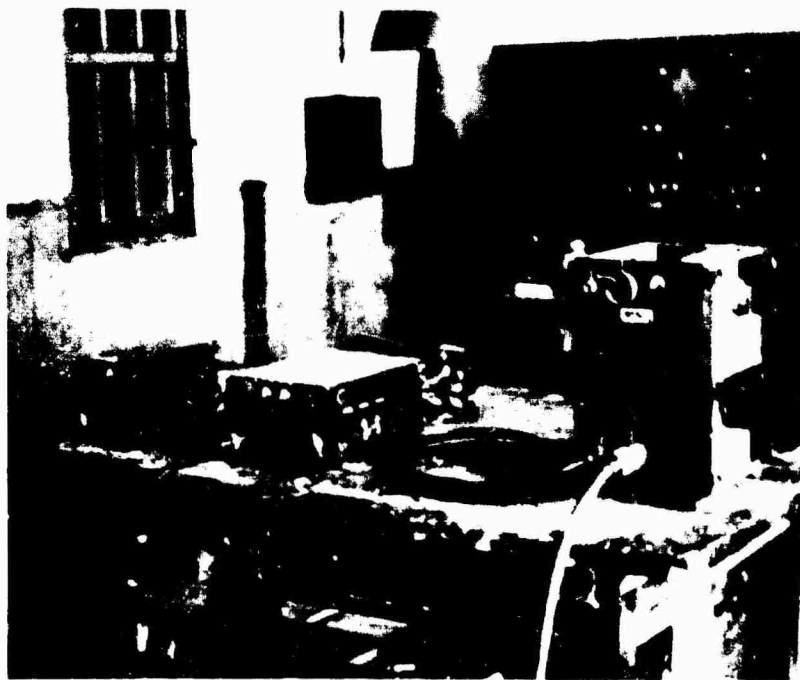
Number Built = 200

Number Installed = A few; none used in combat.

Description:

FK-3 was developed from the original airborne search set H-6, and is considerably lighter and smaller making it suitable for smaller aircraft. It weighs only 40 kg. Two scopes in parallel are provided so that both observer and pilot can keep watch for targets.

The production models of this set began to appear in the middle of 1945; the job from research and specifications to final manufactured product took but 8 months!



Bench Installation of FK-3 Radar -
2d Naval Technical Institute - Kanazawa.

out put power: about 2Kw
frequency: 150mc
pulse length: about 10 micro second
range: about 30 miles for a big ship, Yaglant.
accuracy: $\pm 5\%$



N-6

AIRBORNE PATROL AND SEARCH - SMALL PLANES

Corresponding Allied Designation: ----

Technical Characteristics:

f = 250 MC/S. 2 KW. Range, 40 Km against large ships.
Accuracy: Range, $\pm 5\%$; Azimuth, $\pm 3^\circ$.

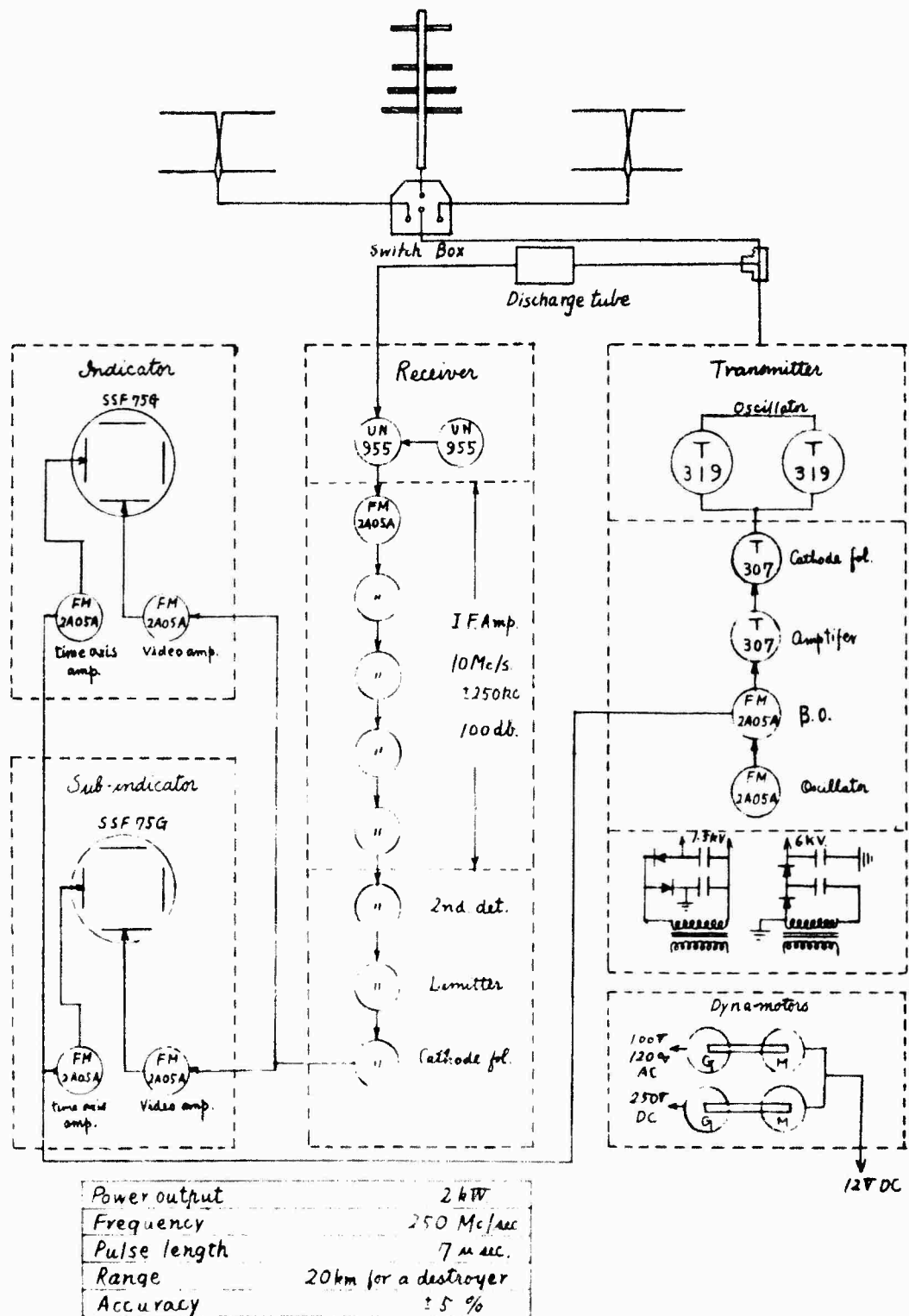
Number Built = 20.

Number Installed = 0.

Description:

This set was designed for small patrol and search planes and used a nose Yagi antenna with doublets on either side of the fuselage. However, difficulty arose in the r.f. receiving end of the set and research on it was discontinued.

RADAR FOR SMALL PATROL PLANE USE (N₆)



FK-4

PATROL AND SEARCH - LARGE PLANES

Corresponding Allied Designation: ----

Technical Characteristics:

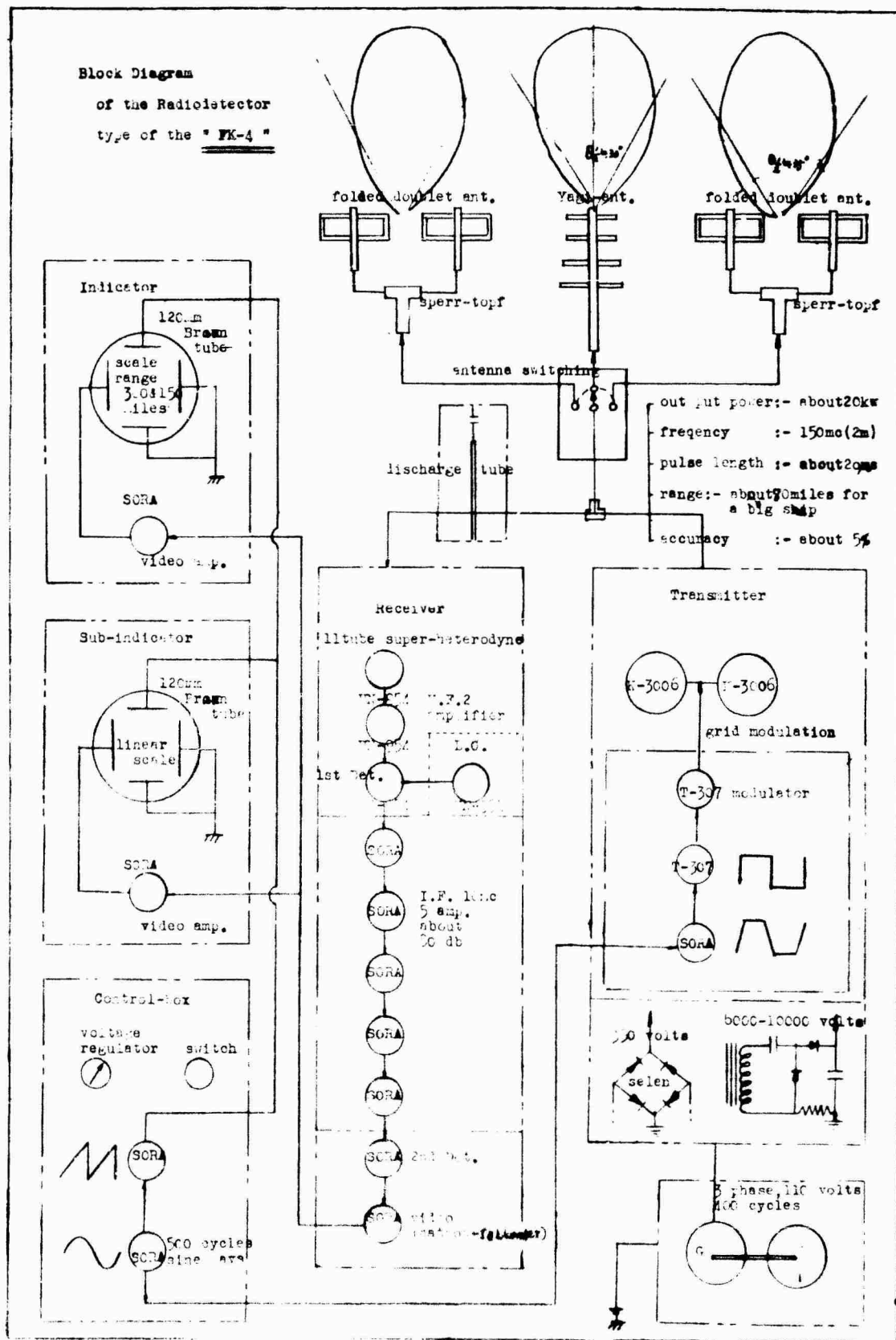
f = 150 MC/S. 20 KW. Range 150 Km against a large ship.
Accuracy: Range, ± 5%; Azimuth, ± 3°.

Number Built = 0. Number Installed = 0.

Description:

This was to have been a high powered patrol and search set for large airplanes. However experimental work on the prototype was stopped in July 1945 because of air raids. A choice of any one of 3 antennas for transmitting-receiving is available. Two scopes, one for the pilot and one for the radar observer, are provided.

Block Diagram
of the Radioteletector
type of the "FK-4"



RADAR NO. 51

PATHFINDER

Corresponding Allied Designation: ----

Technical Characteristics:

Wavelength 10 cm. 6 KW. Range 20 Km. PRF = 600/sec. Pulse width = 1.5 μ s.

Transmitter Tube: Magnetron, M-314, 4 cavity electromagnet of 1200 gauss. Antenna Rotation 1 per sec. Weight = 250 kg.

Number Built = 2 or 3.

Number Installed = 1 for testing.

Description:

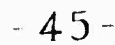
The Pathfinder, No. 51, is the Japanese navy's counterpart of the American ASG and SCR-717B. It is a 10 centimeter, magnetron powered set with a north stabilized 150 mm PPI oscilloscope tube. Arrangement is made for a lubber line to show the heading of the plane at any instant. A second A-display scope reads altitude.

Elaborate silver plated plumbing is used to connect the transmitter and receiver to the main transmission line. A cartridge type crystal, inserted in this complex is the first detector for the superheterodyne receiver which has a 9 tube IF amplifier at 14 MC/S; a T-R tube protects the receiver. A small M-60S magnetron is used as the local oscillator. The antenna as seen in the photos is a parabola clipped at top and bottom and carries a folded antenna with parasitic reflector in front of it. Power is supplied by a 25 v dc dynamotor furnishing 1500 watts of 400 cycle AC at 105 volts.

Preliminary flight results showed that shorelines could be distinguished at 20 km. No ships were seen except from a land based installation of No. 51 at the Kanazawa laboratories.

An interesting sidelight on this set arises from the statement made by navy officers at the 2d Naval Technical Institute that the system characteristics for the No. 51 radar had come from Germany where the equipment was known as the "Rotterdam Gerate." It is believed that the information was obtained from an early Model of H2S equipment carried by a British plane forced down over Rotterdam in the early days of the European War.

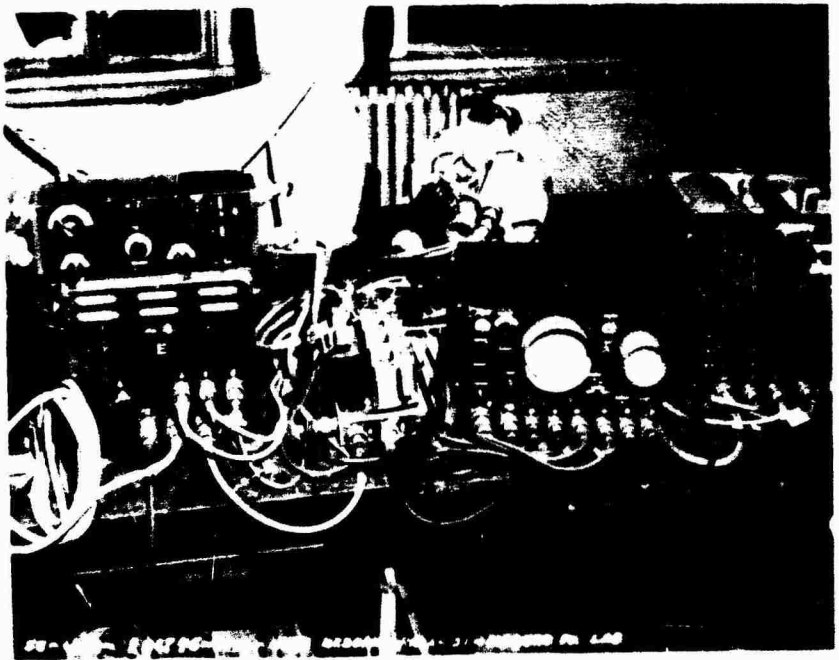
No. 51



This information was received in Japan in 1944. The navy asked the 2d Technical Institute to make such an equipment for them. An attempt was first made to modify the shipborne No. 22 set but not very successfully. A model of the present 51 design was completed in February 1945, and test flown in July at Misawa airfield. It was reportedly completely destroyed in the 9-10 August air raids.

Circuit schematics of the No. 51 set are included in Appendix II of this Survey.*

*The bench model of the No. 51 at the Naval Technical Institute is being shipped to the U.S. by the Air Technical Intelligence Group, Far East Air Forces. A manual of operation will also be available through this unit.



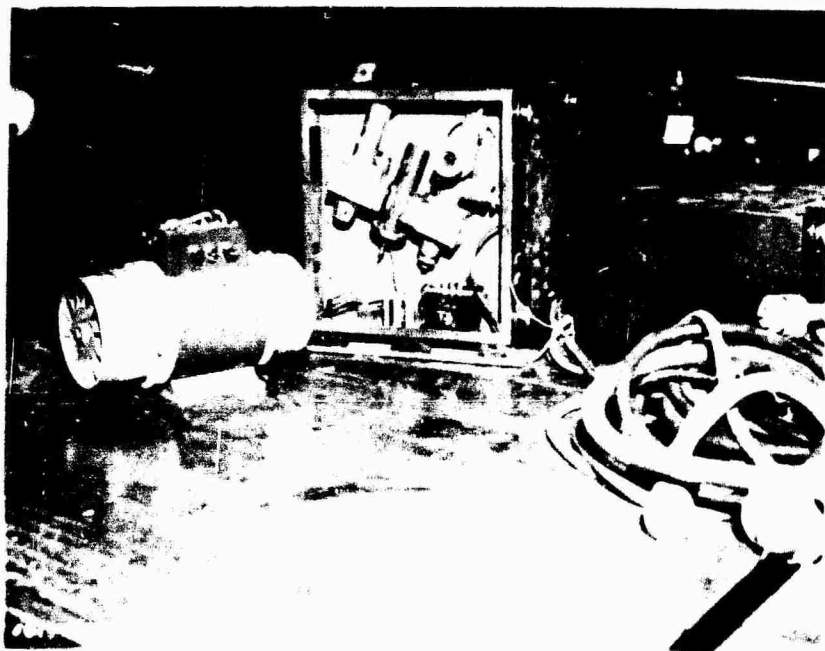
No. 51 - Navy's "Pathfinder" - 10 CM
Airborne Search Radar - Meguro Park.



Detail of Transmitter - Showing Electromagnet
with Magnetron Inserted Axially.



Cut Paraboloid Reflector with Folded Dipole Antenna and Reflector; and Rotary Joint of Airborne Set No. 51.



High Frequency "Plumbing" and 400 Cycle Dynamotor for No. 51 Set.

L-2 AND L-3

SEARCHLIGHT CONTROL

Corresponding Allied Designation: Mark 4 Model 3.

Technical Characteristics:

f = 200 MC/S. L-2; 10 KW. Range 15 Km.

L-3; 13 KW. Range 20 Km.

Accuracy: Range, L-2, + 150 M; Azimuth, + 1.5°.

Range, L-3, + 100 M; Azimuth, + 1.5°.

Number Built = L-2's: 170

L-3's: 70

Number Installed = Many

= Few

Description:

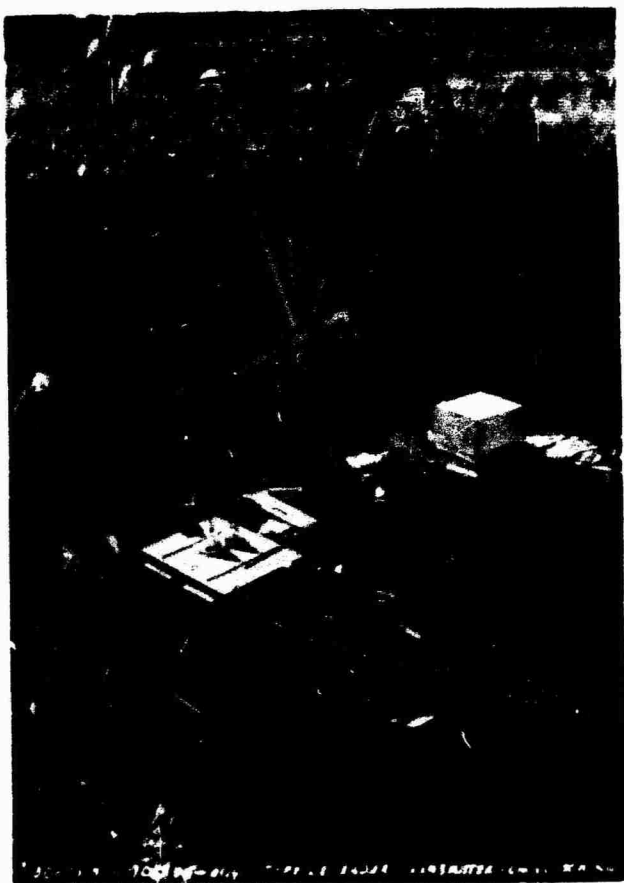
The L-3 set so closely resembles the L-2 that it is difficult at first glance to tell them apart. The L-3 has slightly higher power and consequently improved range and is provided with an additional cathode ray tube with expanded range scale. The transmitter consists of a pair of Yagi arrays mounted on a turntable. The receiving antenna is mounted on a framework fastened to the light itself perhaps 50 yards distant from the transmitter. It consists of 4 separate Yagi antennas. The signals received by them are switched from one to the other in rapid sequence. The comparison of strengths of these signals then gives a means for determining which direction to move the light to get on target. An operator at the receiver hut watches an A-scope on which all target echoes show up to 20 km. He moves by means of a hand crank range knob a bright spot along the axis until it coincides with the left edge of a target echo. All targets appearing to the right of this spot for a range of 1000 meters are gated over to the vector display at the transmitting station. (In the L-3 model this same 1000 yards is displayed in expanded form across the face of a second A-scope by means of which the operator can obtain more accurate range estimates. This expanded scope is not supplied in the L-2 set.) The operator who rides around with the mount has control over the rotary motion by means of a pair of handle grips; he can by the same controls alter the elevation angle of the antenna. The rider is supplied with a 75 mm cathode ray tube on which a vector type of display shows him which way to move the antenna for exact centering. If the target is exactly centered a small bright spot only shows in the center of the scope. If the target is higher than the antenna axis a bright line on the scope extends upwards from the center spot. Likewise a line shows to the right if the antenna is off center left. Errors in both elevation and azimuth produce a sloping line pointing from the center spot in exactly the direction the antenna should be moved to get "on target." Hence the name vector presentation. The rider also has a pair of .20 power 120 mm objective lens field glasses through which he spots the planes visually whenever possible. The searchlight is connected to the transmitter turntable by selsyns and follows automatically the movements of the transmitting antenna so that when the transmitting antenna is "On Target" the

L3

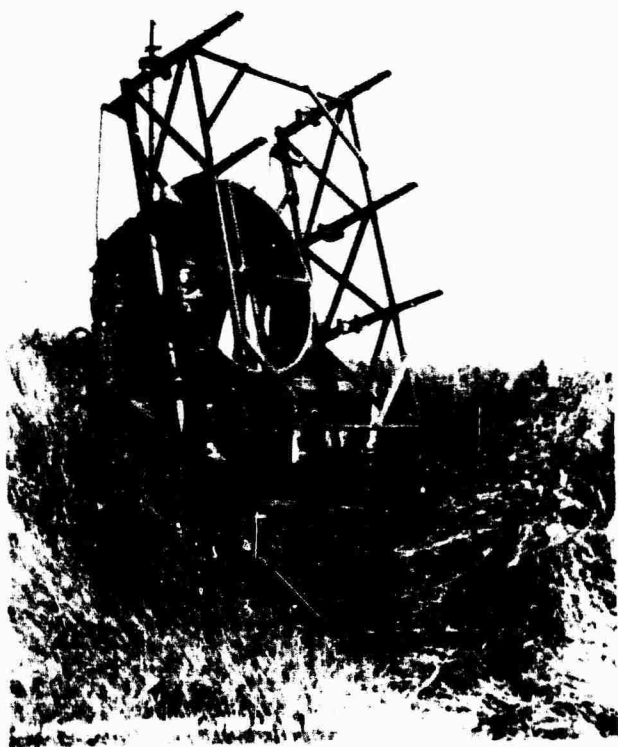


the searchlight is also On Target.

The Sumitomo Company manufactured about 70 of the L-3 equipments, but nearly 60 of them were destroyed in the factory by bombings. Only a few of this latest model actually saw use.



An Operator
rides around on
this turntable
which carries the
antenna and the
transmitter of
the L-2



Four sets of
Antennas are
mounted on the
Searchlight
frame; by equalizing
the signals from
opposite antennas
the light is held
"On Target"

S-3 - (or TYPE 41)

ANTI-AIRCRAFT FIRE CONTROL

Corresponding Allied Designation: Mark 4 Model 1.

Technical Characteristics:

f = 200 MC/s. 15 KW. 20 Km.

Accuracy: Range, \pm 100 M; Azimuth, \pm 1°.

Number Built = 80.

Number Installed = Numerous

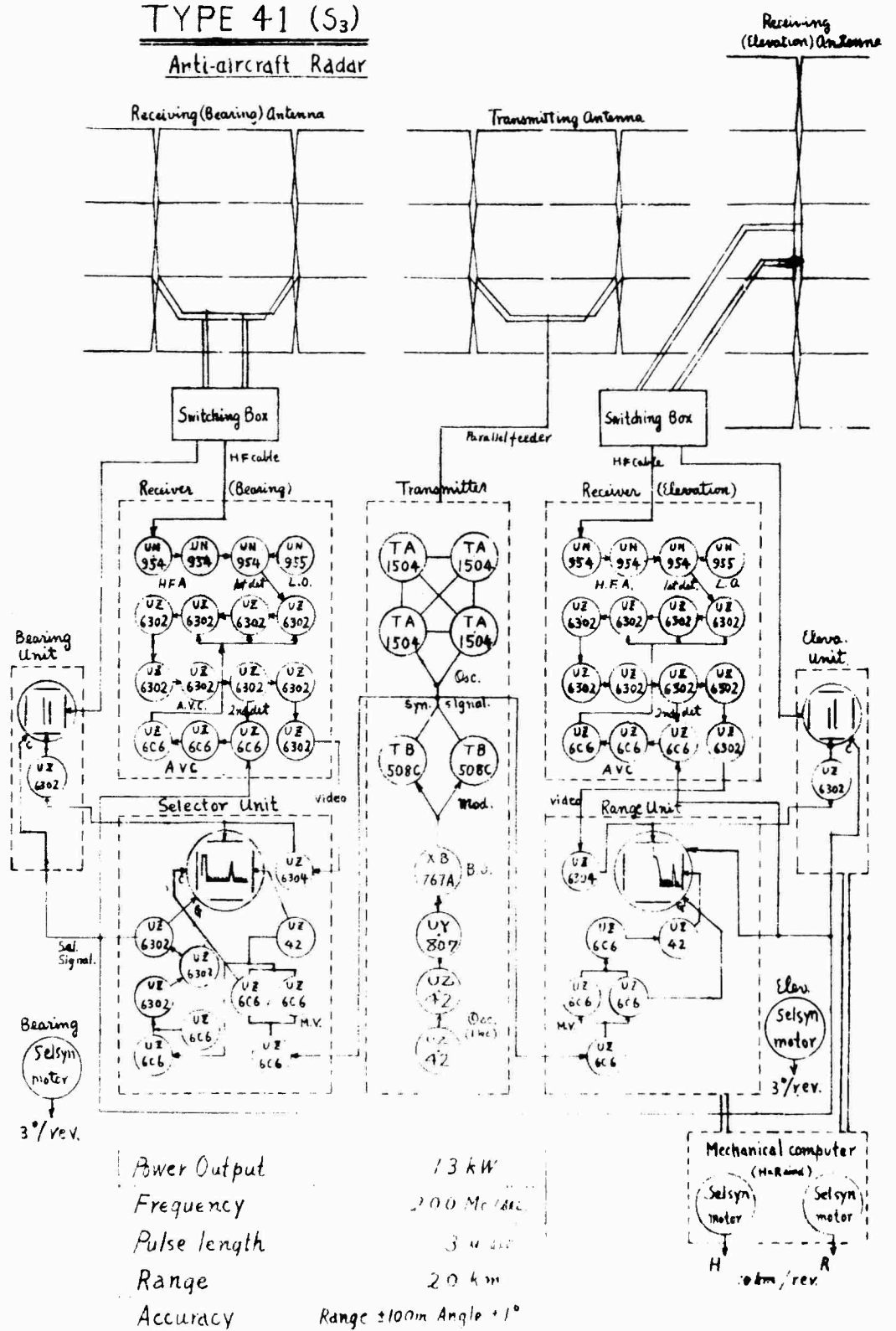
Description:

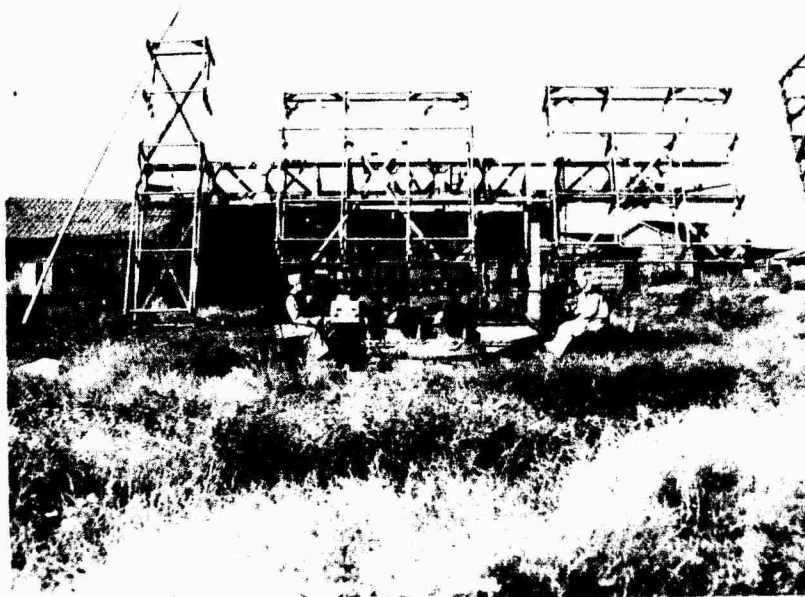
This equipment is a close copy of the American SCR-268. In May 1942 the Japanese captured a "268" at Corregidor. "Research" on the S-3 is indicated by the Japanese navy laboratory as having begun in August 1942, and was completed a year later.

Difficulties in manufacture arose which held down production at the Sumitomo company to 5 per month. Moreover in the field it was found to be a most difficult and complicated set to maintain. This led to the development of other more satisfactory types of S/L and AA control radars. Four scopes are used, an A-type range scope showing all targets on the scale to 150 km, a selector scope on which a particular target is chosen, and two plp matching scopes, one for azimuth and one for elevation centering.

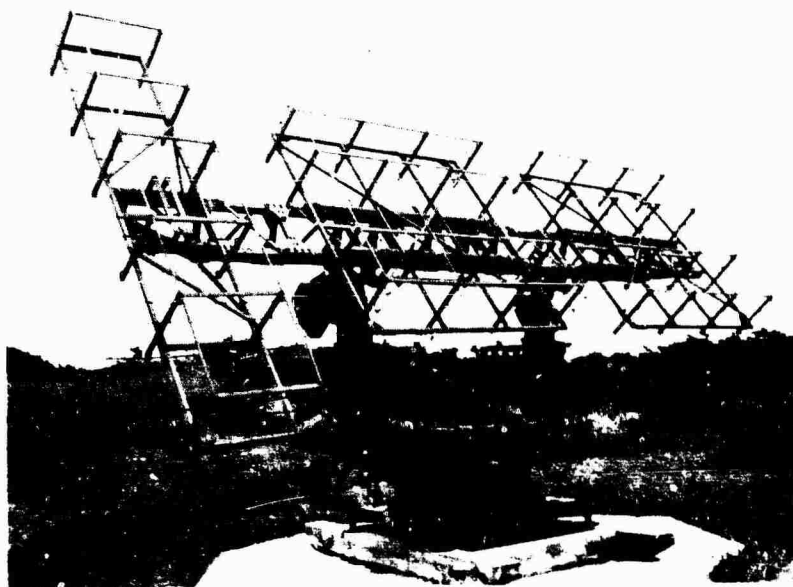
TYPE 41 (S₃)

Anti-aircraft Radar

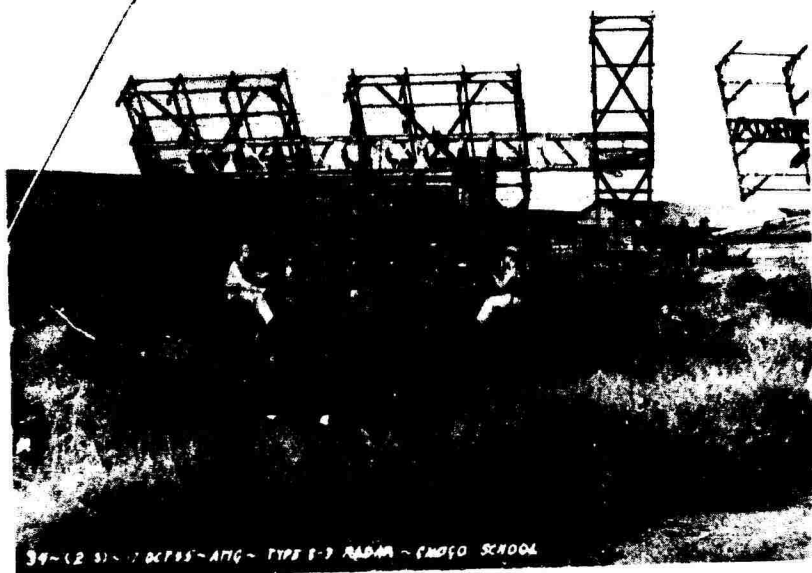




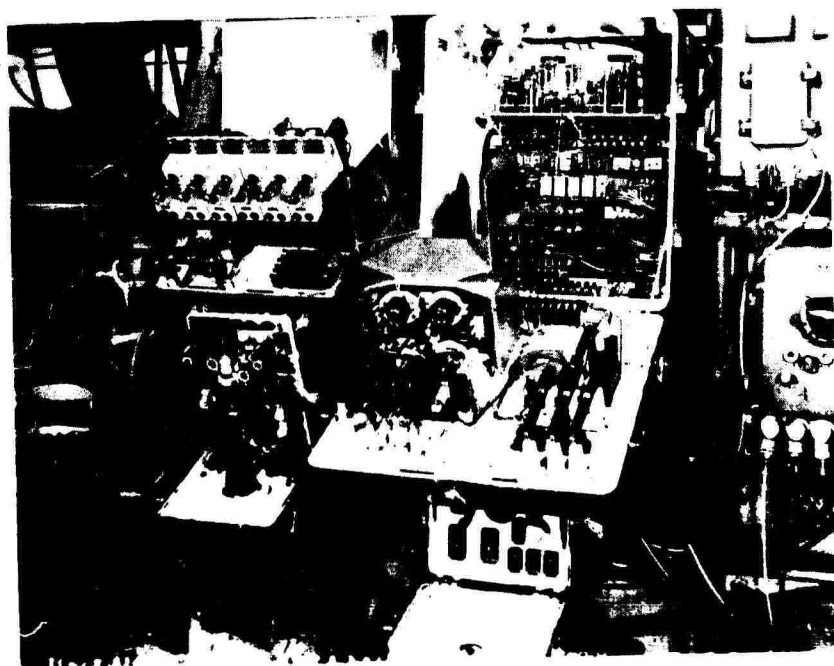
S-3 Navy Fire Control Radar -- Similar to
American SCR-268 -- Chogo.



Detail of Antenna, S-3 Radar -- Chigasaki.



Rear View of S-3 Radar -- Chogo.



Equipment Compartments Opened, Showing
Easy Access for Maintenance -- S-3.

S-23

ANTI-AIRCRAFT FIRE CONTROL

Corresponding Allied Designation: Mark 4 Model 2.

Technical Characteristics: (same as L-2)

f = 200 MC/S. 10 KW. Range = 15 Km.

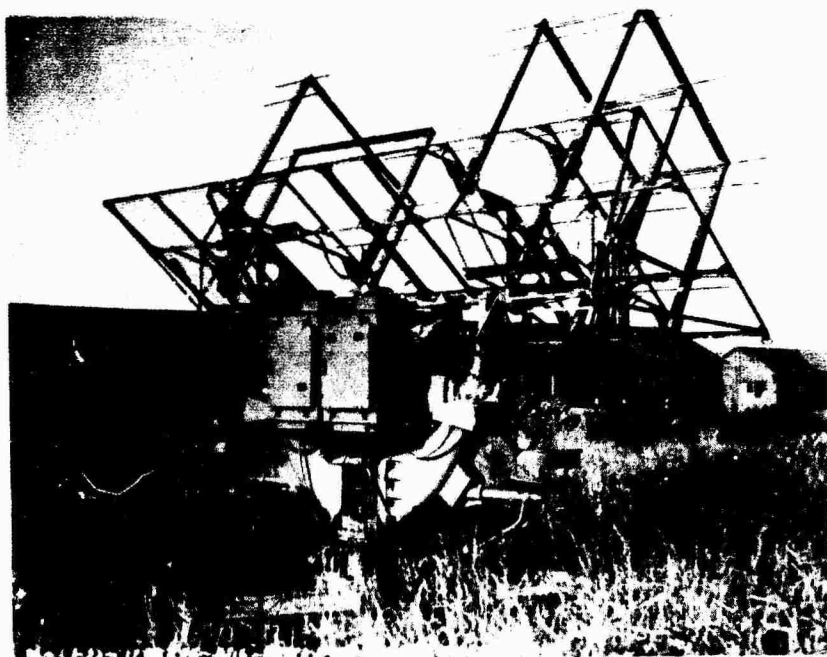
Accuracy: Range, ± 150 M; Azimuth, ± 1.5°; elevation, ± 1.5°.

Number Built = 20.

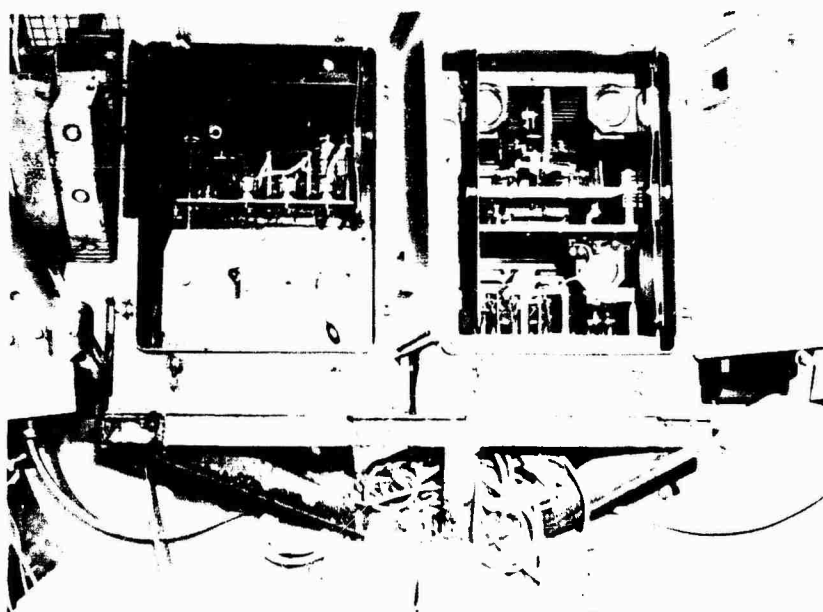
Number Installed = 0.

Description:

The S-23 was a stopgap set built to use until the S-24 would be ready. It used the equipment from the L-2, with a simple array antenna. The whole set was mounted on the turntable formerly used for their acoustical detectors. Range and accuracy were about the same as the S/L sets, which were not good enough for AA firing. The S-24 was finished almost as soon as the S-23, the latter then was obsolete before it was used.



First Japanese Navy Fire Control Radar S-23
Adapted from L-2 Searchlight Controller.



Equipment detail of the S-23 radar.

S-24

ANTI-AIRCRAFT FIRE CONTROL

Corresponding Allied Designation: Mark 4 Model 2, Modification 2.

Technical Characteristics:

$f = 200 \text{ MC/S.}$ 13 KW. Range 20 Km.
Accuracy: Range, $\pm 50 \text{ M}$; Azimuth, $\pm 1^\circ$.

Number Built = 80.

Number Installed = About 60.

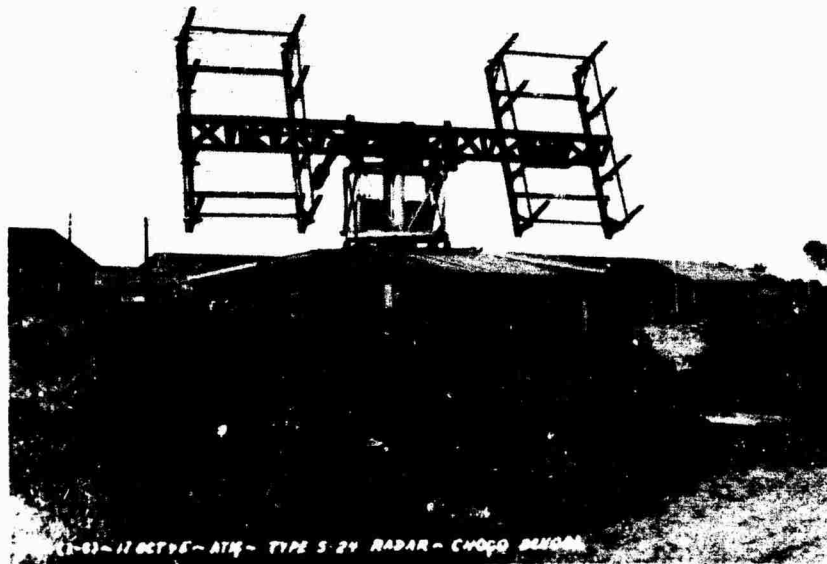
Description:

While the S-3 (SCR-268 copy) was undergoing "research", another set to do the same fire control job, the S-24, was under development. This appears to have been an adaptation of a British SLC model. It turned out to be both more accurate than S-3 and considerably easier to maintain.

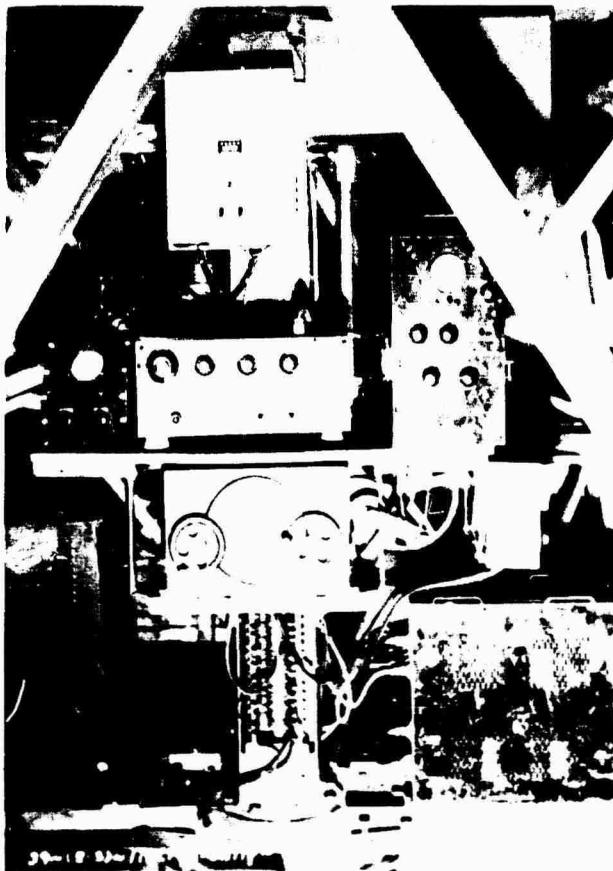
The presentation is by means of four cathode ray tubes. One is a range tube with all returning echoes showing and a rough scale below the base line with range marker pips. Another range tube has a magnified horizontal scale so that a range marker can be placed accurately against the returned signal. This set also gates the pulse over to the azimuth and elevation pip matching scopes, where operators attempt to stay on target by pip matching.

S 24

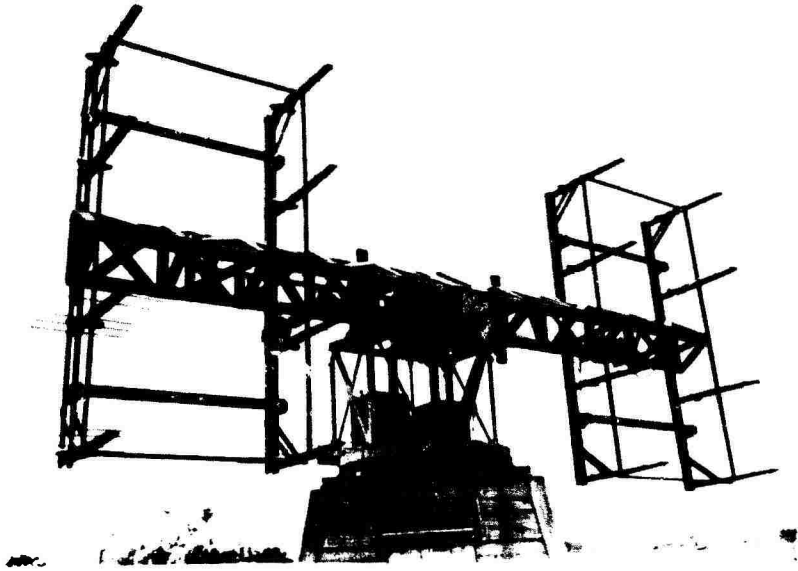




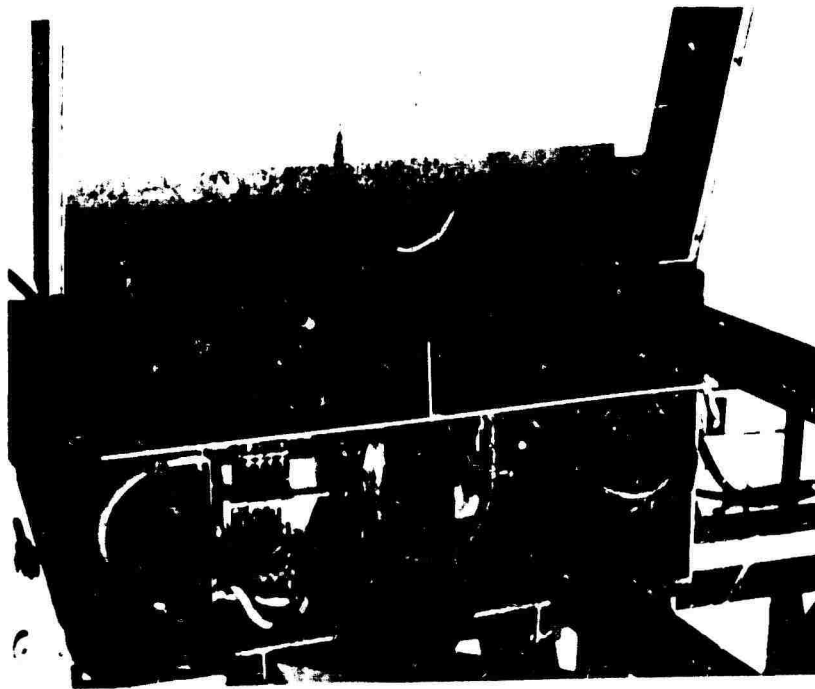
S-24, Navys Latest (In Use) Land Based Antiaircraft
Fire Control Radar -- Chogo.



Receiver and
Indicator
Equipment,
S-24.
The operators
and equipment
ride around
on a turn
table inside
the hut.



Detail of Antenna of S-24 Radar.



Lobing Switch and Motor Located on Back
of S-24 Antenna.

HAMA 61 (or S_{8B})

FOR ALTITUDE MEASUREMENT

Corresponding Allied Designation: ----

Technical Characteristics:

f = 500 MC/S. 10 KW. Range 50 Km.

Accuracy: Range, \pm 200 M; Azimuth, \pm 0.5°; Elevation, \pm 0.5°.

Number Built = 3.

Number Installed = 0.

Description:

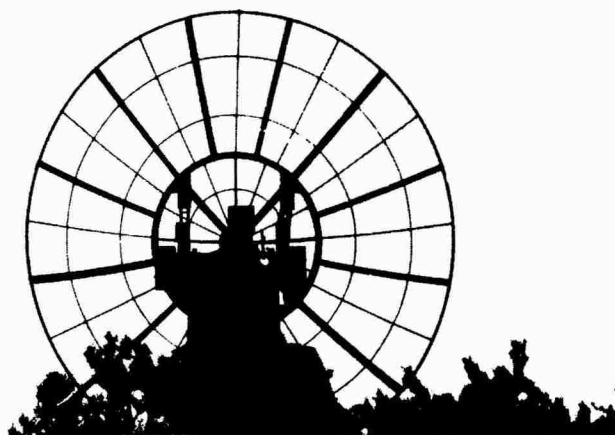
Originally a 58 cm set known as S-8 was designed for a shipboard locator; however it did not prove superior to the No. 22 equipment already in use so the plans were altered slightly and No. 61 was devised to fill the need for measuring airplane heights from the ground.

It appears to be a rough Japanese-made copy of the German Wurzburg. It has the same r.f. frequency of 500 MC/S. The paraboloid antenna is 7 meters in diameter and puts out a 4° beam from an offset dipole which is rotated at 1100 rpm to give lobing in both horizontal and vertical directions. The display is on 4 cathode ray tubes; one is an observer's tube which shows all the targets on an A-type scope with 135 km range; another reads range to the target desired and gates the target pip for viewing in split form and height matching on the azimuth and vertical angle scopes. A commutator on the dipole rotating motor shaft is used to switch the video signals to the proper scope deflection plates. The "gate" used here, however, is quite large being some 10 km long so that occasionally several targets may be included at one time. To care for this contingency the azimuth and elevation operators can push a button which collapses the spread in their otherwise split presentation. This calls the attention of the selector operator who then puts a "black spot" on the particular target desired. When this is done the pip to be spread and matched is exactly centered on the azimuth and elevation scopes.

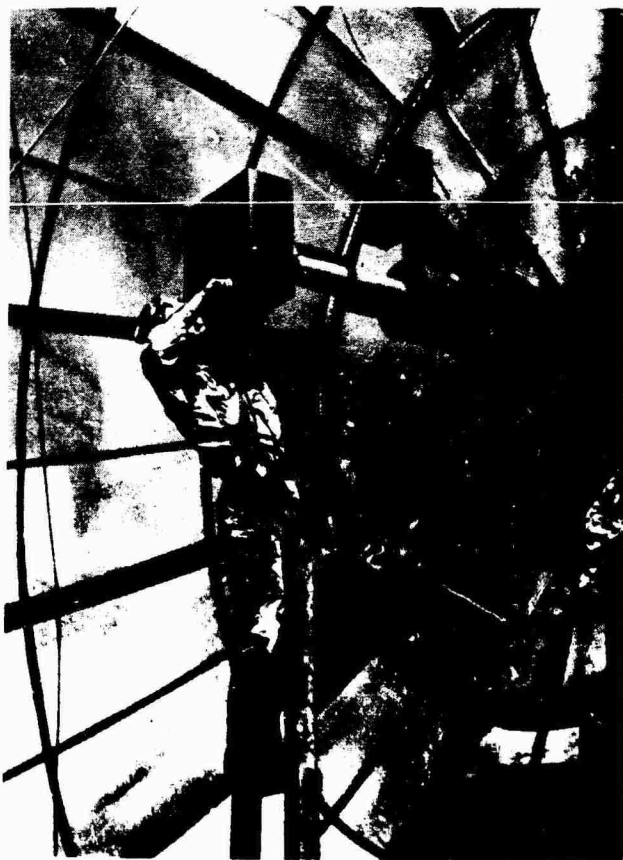
With this equipment it would be difficult to search for targets so it is used in conjunction with a longer wavelength set (such as Radar No. 63) until the latter has selected a special target for No. 61. In GCI practice the No. 61 set would be put on the enemy fighter for close tracking, while Set No. 62 would track the friendly fighter.

Hama 61

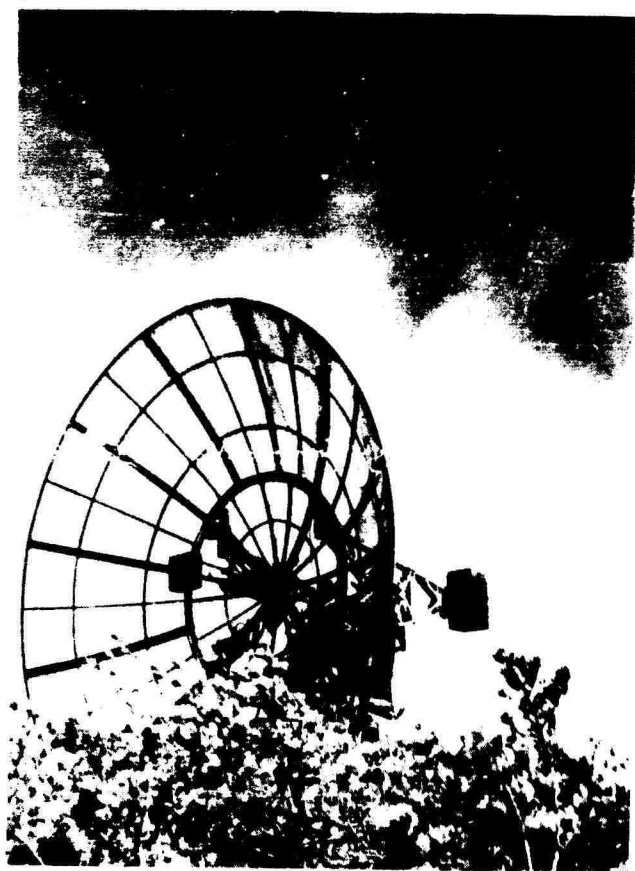
AC 220 V Supply



Hama 61 Antenna - Head on View - Chigasaki.

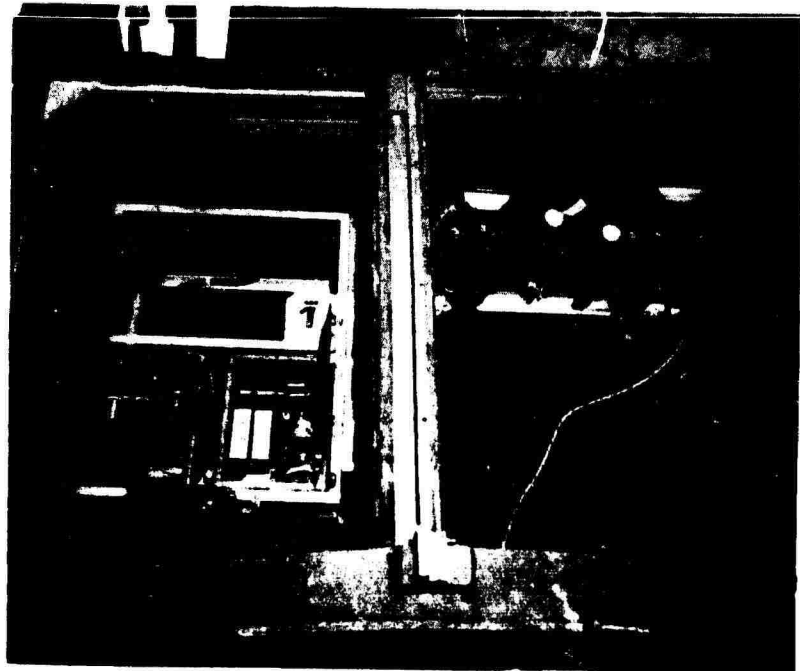


Detail of
Box Housing
Offset
Rotating
Dipole.



Hama 61 Radar
 For Tracking
 Enemy Planes
 (500 MC/S)
 Resembles
 German
 Wurzburg

 Chigasaki



Transmitter Close up from Below - Hama 61.

TYPE 32-(or 105S₂) AND 31

ANTI-SURFACE FIRE CONTROL FOR SHIPS

Corresponding Allied Designation: ----

Technical Characteristics:

Wavelength = 10 cm. 2 KW. Range 35 Km against battleship.
Accuracy: Range, ± 100 M; Azimuth, $\pm 1/2^\circ$.

Number Built = 60.

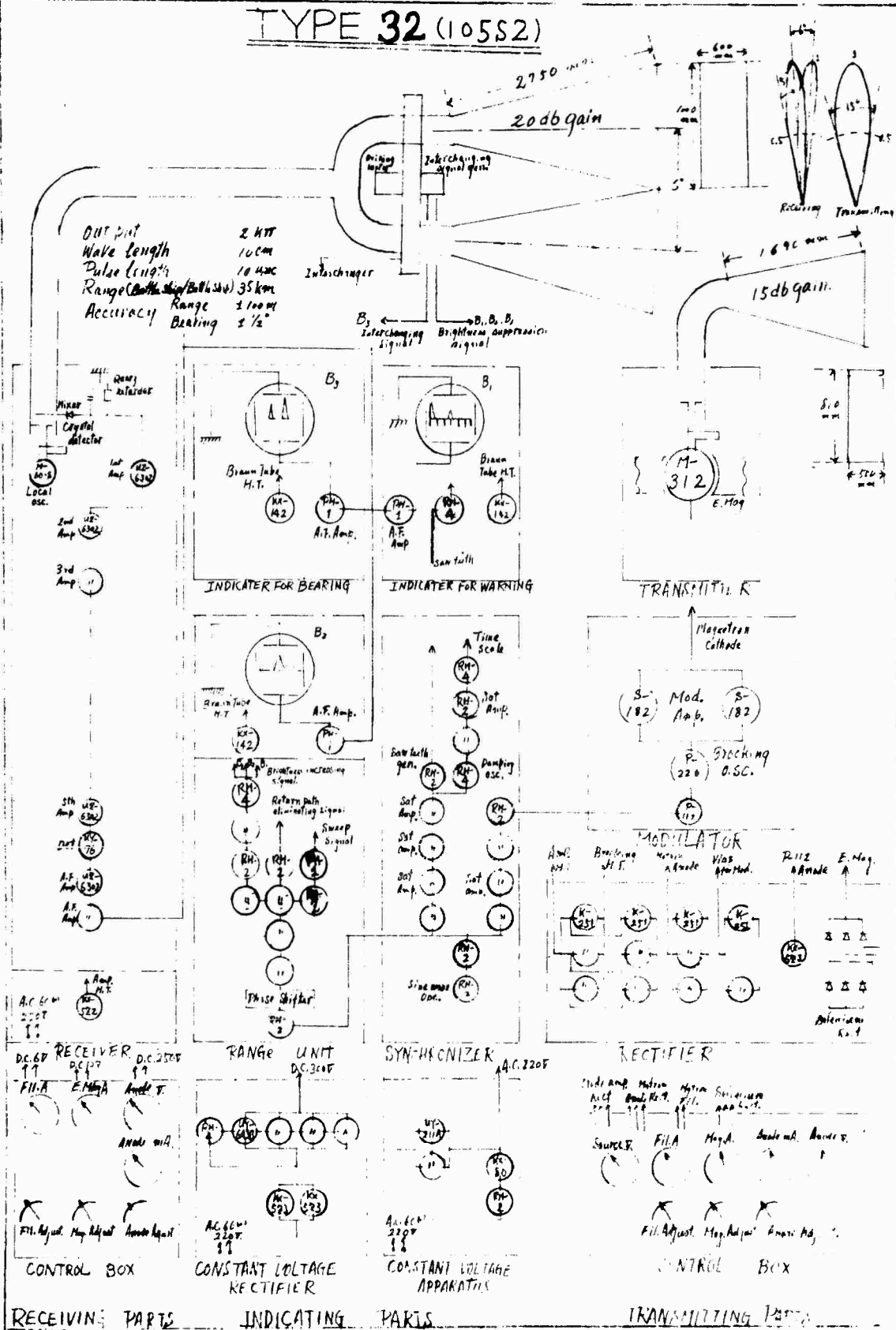
Number Installed = 0.

Description:

This is a simple modification of the No. 22 shipborne 10 cm search set, in which the receiver is alternately switched to each of a pair of receiving horns with slightly diverging axes. This produces a pair of lobes with about 6° spread. The received signal pips are matched in magnitude on a suitable "Bearing" cathode ray tube to obtain an azimuth accuracy in the order of $\pm 1/2^\circ$. A variety of horns have been tried, some round and some square in cross-section, some long and some short.

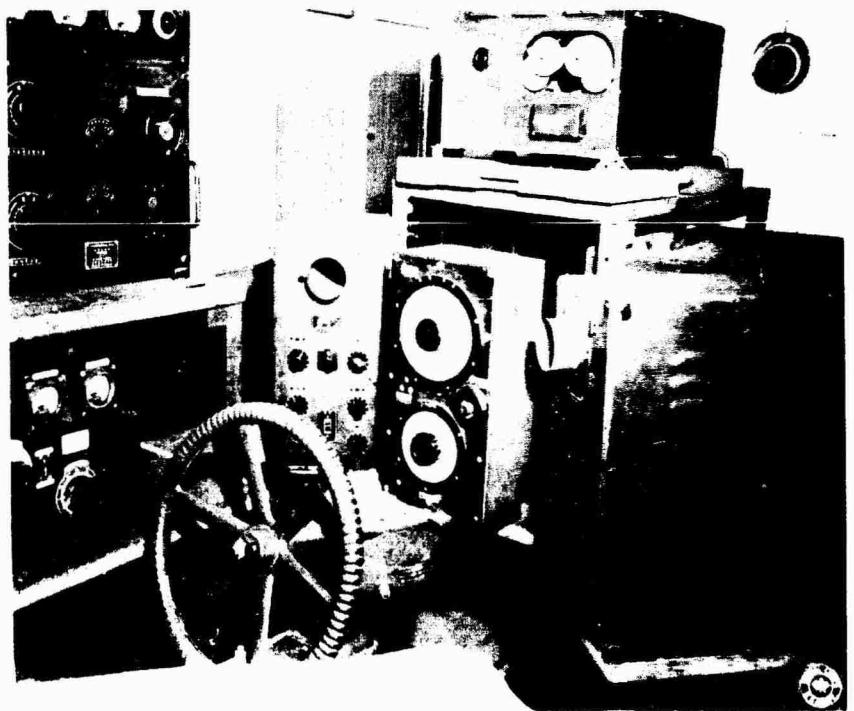
In order to increase the azimuthal accuracy a paraboloid reflector with a dipole moved rapidly horizontally was being experimented with on the No. 32 set at the navy's test station at Tsukishima on the eastern outskirts of Tokyo. Photos of this trial installation are also shown. It was designated as set No. 31.

TYPE 32 (105S2)

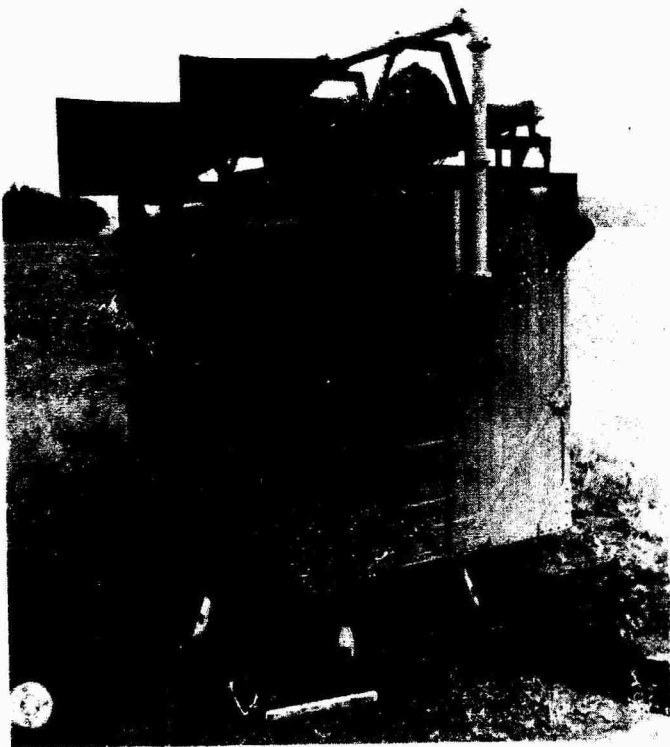




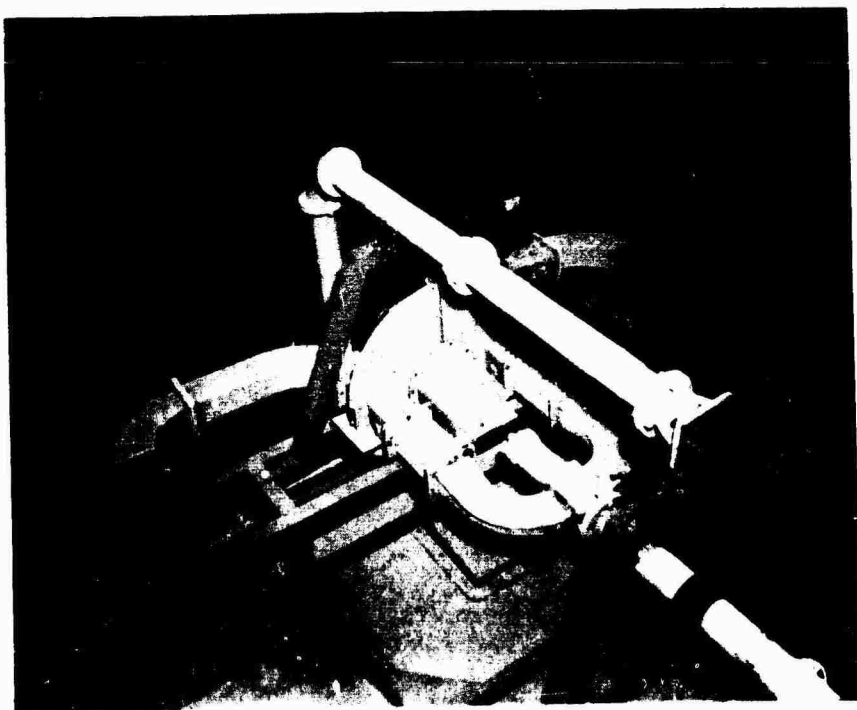
Type 32 10 CM Surface Fire Control Radar -- Chogo.



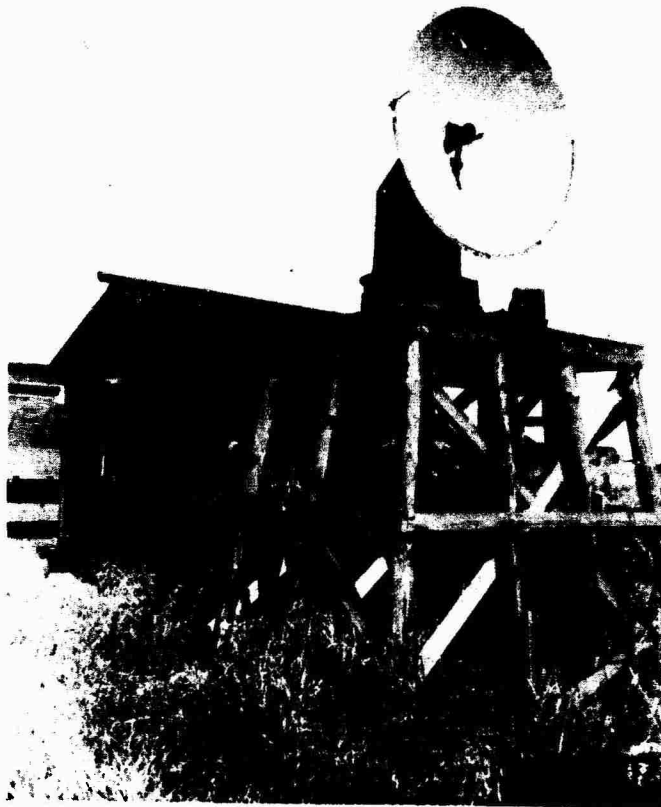
Operators Position in No. 32 Set Shown Above.



Rear View
of No. 32
Fire Control
Set Showing
Horn and Wave
Guide Con-
struction.

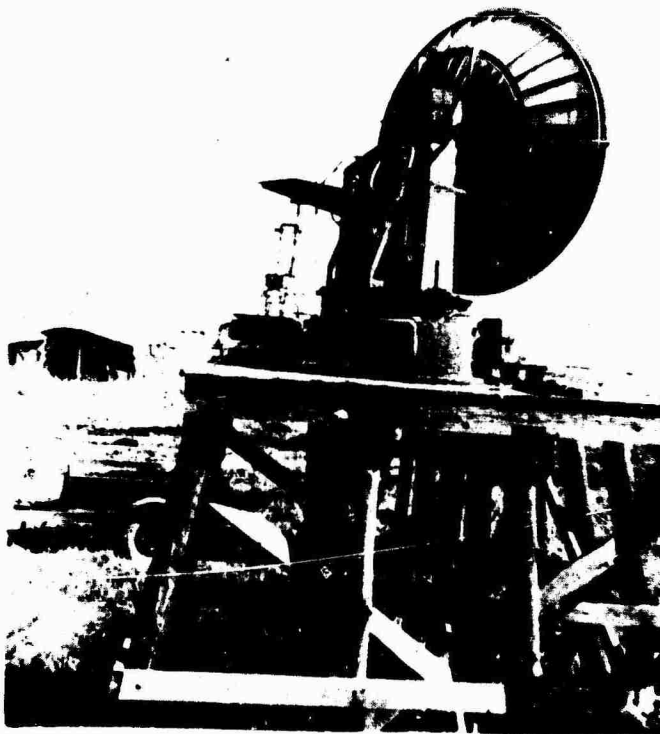


Detail of Lobe Switch on Receiving
Antennas of Radar No. 32.



No. 31
Experimental
10 CM Paraboloid
Antenna with
Horizontal Lobe
Switching

Tsukishima.



Rear View of
Experimental
10 CM Parabola.

FD2 RADAR

NIGHT FIGHTER

Corresponding Allied Designation: ----

Technical Characteristics:

f = 500 MC/S. 2.5 KW. Range 3 Km against medium-sized aircraft.
Accuracy: Range, $\pm 5\%$; Azimuth, $\pm 0.5^\circ$.

Number Built = 100.

Number Installed = *NONE IN COMBAT*

Description:

FD-2 was developed from FD-1 a 150 MC/S patrol set which upon test in 1943 by the navy was found to have inadequate range, and was therefore not accepted for use. Although FD-2 gave ranges of 3 km against other planes, and 10 km against ships it too was found not to have sufficient range.

This set uses a set of 4 forward looking Yagi antennas, one pair for sending and one pair for receiving. Horizontal lobe switching is done within each pair and synchronized between pairs by means of a motor operated mechanical switch. A CRT display showing range of the target and the degree of azimuthal homing on it is used; this is very similar to the display used in the American SCR-521.

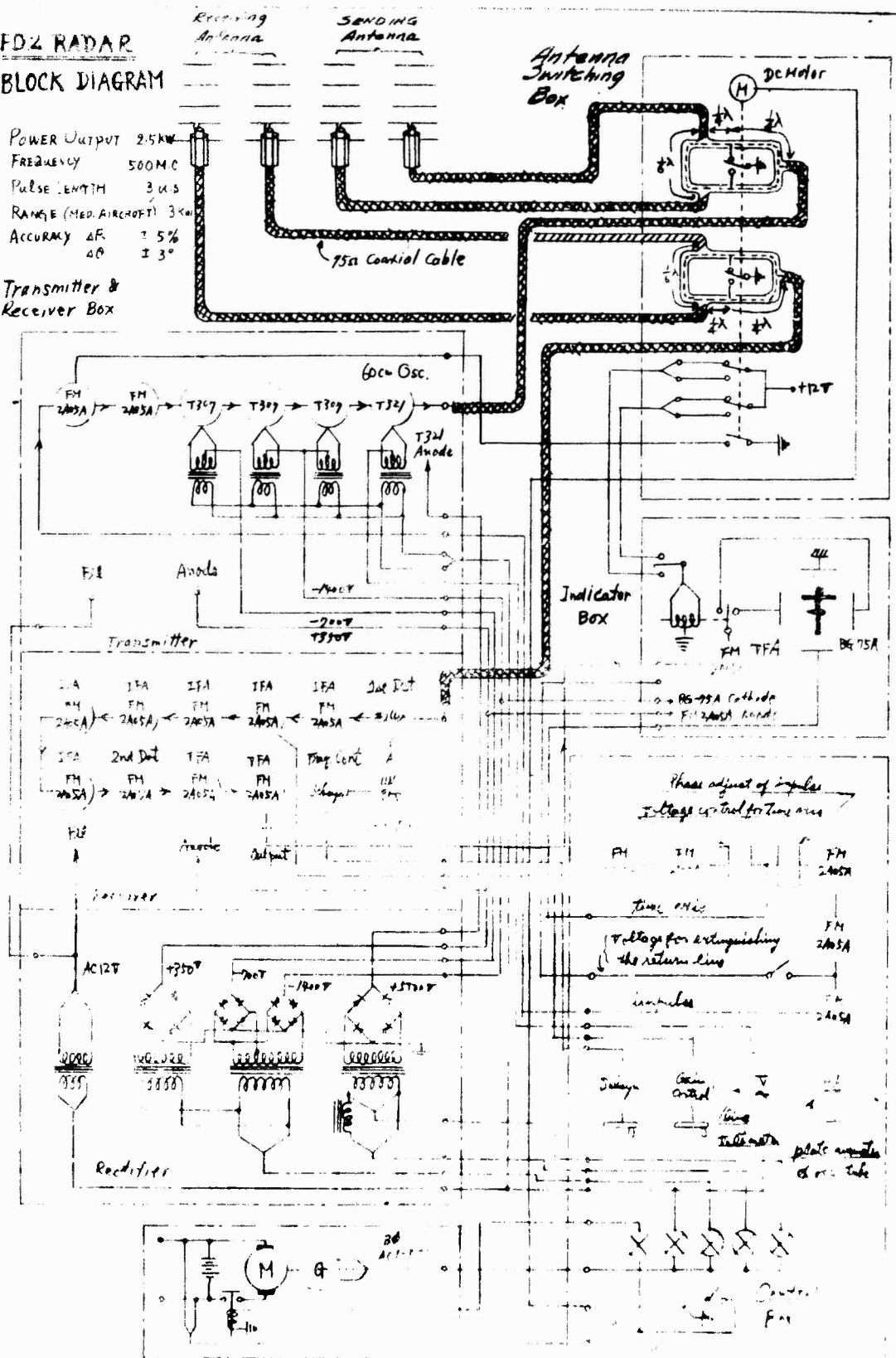
The notation FD-2 is a local designation given by the 2d Naval Technical Institute during its development. The "F" comes from the German word "flutzeig" or to fly, and "D" comes from its decimeter wavelength.

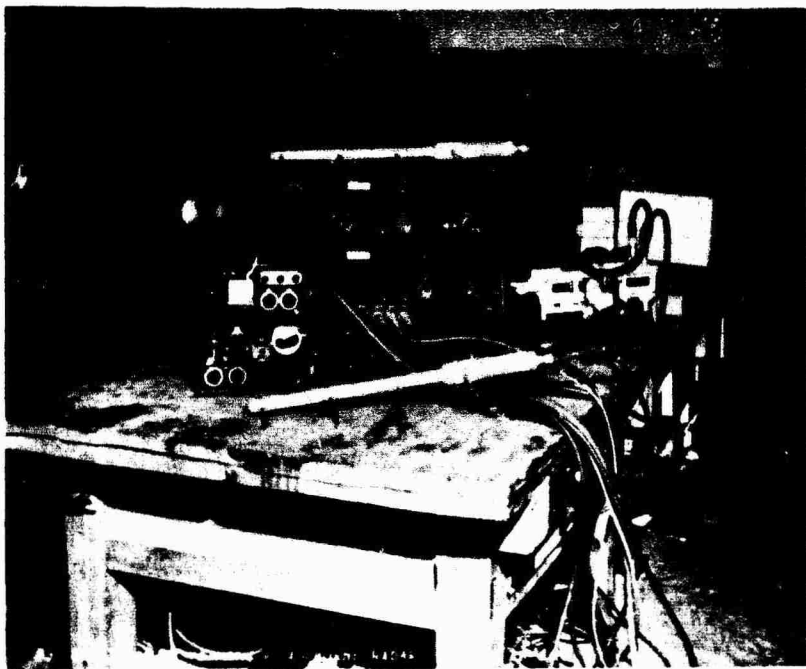
The Meguro Park Laboratory model of the FD-2 is being returned to the United States by the Air Technical Intelligence Group, Far East Air Forces.

FD-2 RADAR
BLOCK DIAGRAM

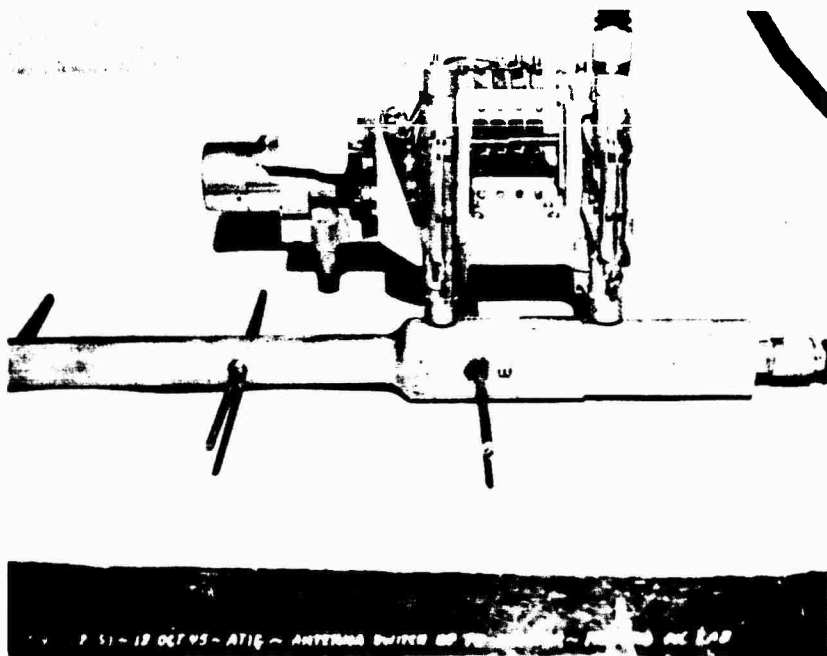
POWER OUTPUT	2.5kW
FREQUENCY	500MC
PULSE LENGTH	3 uS
RANGE (MED. AIRCRAFT)	3 km
ACCURACY ΔF	$\pm 5\%$
$\Delta \theta$	$\pm 3^\circ$

Transmitter &
Receiver Box





FD-2 Night Fighter Radar; Bench Installation at
Navy Laboratory, Meguro Park, Tokyo.



Antenna Switch for FD-2 with One of the 4
Antennas Showing.

GYOKU 3

NIGHT FIGHTER

Corresponding Allied Designation: ----

Technical Characteristics:

f = 150 MC/S. 3 KW. Range 4.5 Km against a medium-sized plane.
Accuracy: Range, $\pm 5\%$; Azimuth, $\pm 5^\circ$.

Number Built = 10.

Number Installed = A few.

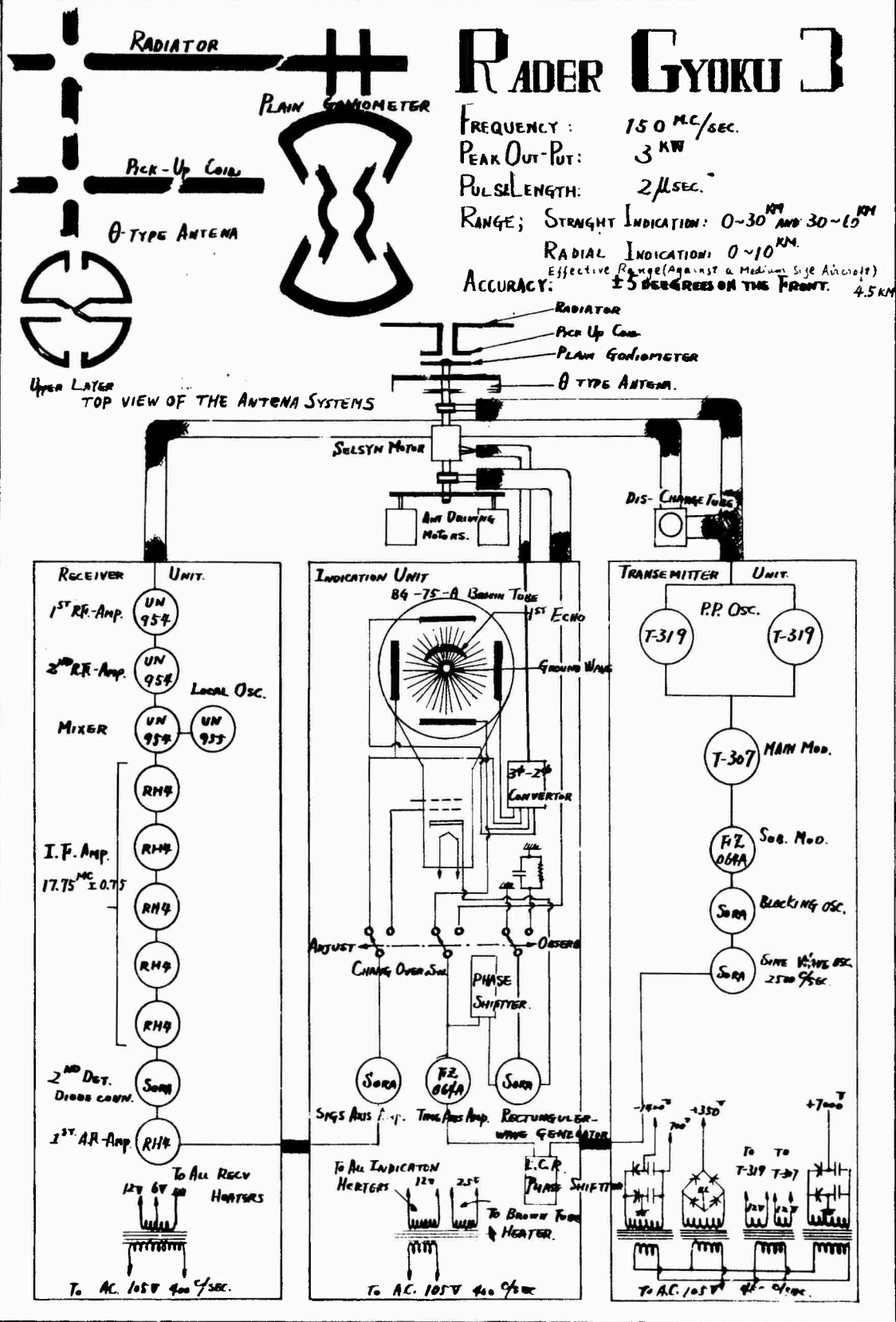
Description:

Gyoku-3 is a newly completed Japanese navy night fighter set operating at 150 MC/S. A specially constructed antenna making use of direction finder technique produces a conical scan in a forward direction. The radiating elements which are mounted, axis coincident with that of the plane, do not move. The pick up coil leading to the 2 pairs of dipoles is fed in such a manner by a rotating coil that the pair of lobes they generate rotates about the axis of the plane much as the propeller does. This pattern is shown in the sketch below in the "Front" view, as one faces the plane. Superimposed on this rotating field is a fixed doughnut shaped field created by the so-called antenna. The addition of the two fields produces a rotating cardioid. The corresponding side view of the patterns are shown in each case.

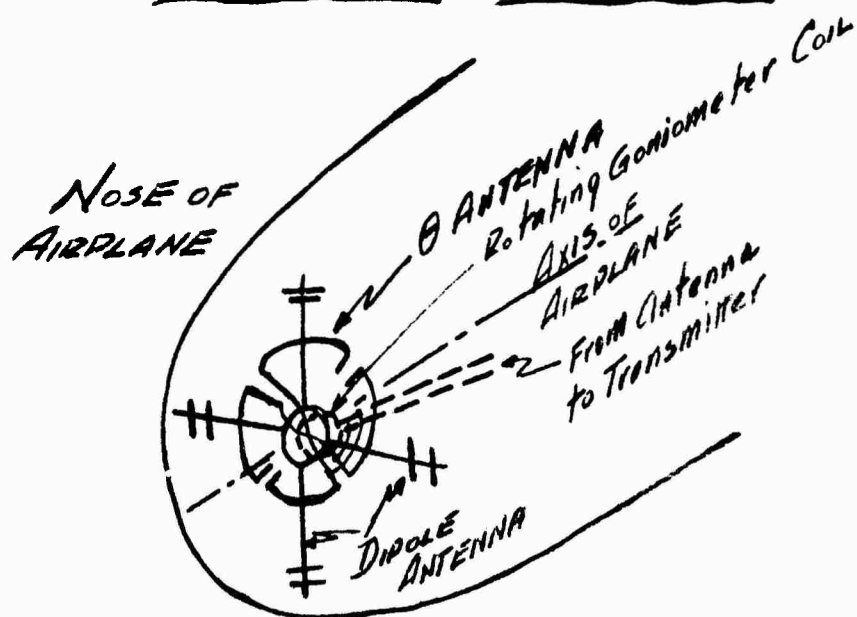
The lobe created in this fashion is very broad as indicated by the low antenna gain of 2.5 to 3.0 db. It is rotated at 900 rpm by a motor driving the feeding goniometer coil. A coverage of about 140° in front of the plane is obtained. The image on the selsyn synchroized PPI screen of course is very broad, giving a discrimination at best of about 5° . The designers were very insistent that such a broad beam was necessary in order to be sure of picking up any plane ahead of the night fighter.

Daytime flight tests at Yokosuka Naval Base showed a range of 4.5 km on a medium type plane as target. No night or blind interceptions were attempted.

The name Gyoku is a naval laboratory name derived from Gyoku-sai, meaning "all suicide."



GYOKU-3 ANTENNA



ANTENNA

DIPOLE

FRONT VIEW OF PATTERN FACING NOSE OF PLANE

SIDE VIEW OF LOBES

⊖

⊖ Pattern →

Dipole Pattern →

COMBINED PATTERNS

$$B = A(60 \sim 70) \%$$

HAMA 62

FRIENDLY AIRCRAFT LOCATOR - LAND BASED

Corresponding Allied Designation: ----

Technical Characteristics:

Wavelength 2 M. 10 KW. Range 130 Km.

Accuracy: Range, + 0.8 Km; Azimuth, + 0.4°.

Number Built = *FEW*

Number Installed = *NOT YET USED*

Description:

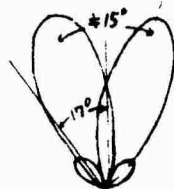
Radar No. 62 is a ground GCI set for installation near fighter airfields; its function is to accurately determine the location of the friendly fighter plane. The friendly fighter is equipped with an M-13 navy IFF set with its controls set to respond to one frequency and retransmit at a slightly different one. The No. 62 transmitter can send at any spot frequency in the range 150 mc + 5 MC/S to correspond with the IFF setting. The ground receiver is then tuned to the retransmit frequency (slightly off its own transmitter frequency). This eliminates ground echo returns and brings in only the desired fighter plane. Flat plates are used for the No. 62 antenna dipoles to permit efficient radiation over the required frequency band.

A range scope and an azimuth pip matching scope comprise the display. A motor driven lobe switch is located just behind the screen reflector on the antenna.

Radio Locator — Hams 62

for Guiding Friend Fighter

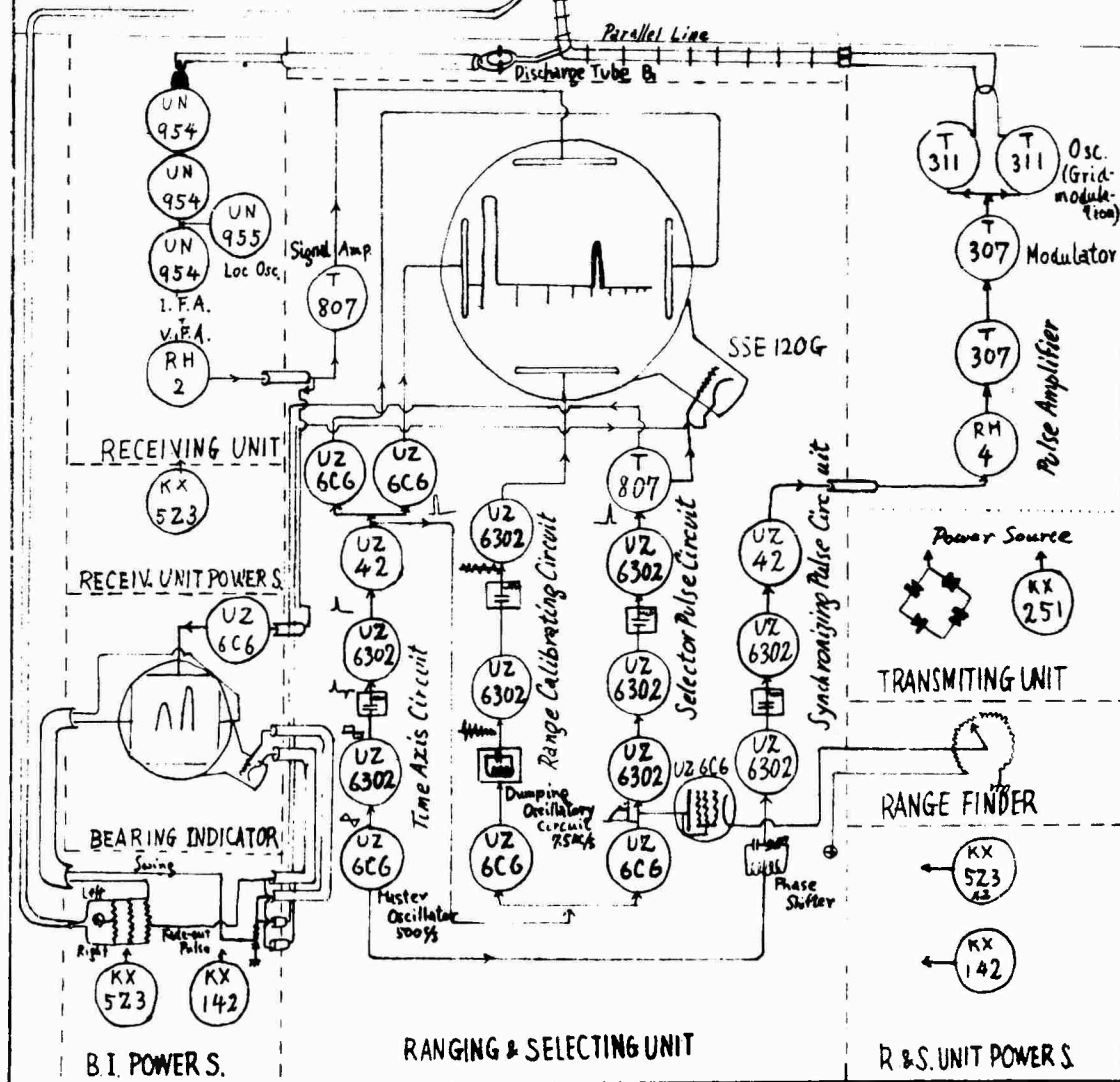
Power Output : 10 KW
Pulse Length : 10 μ sec
Range : 130 Km
Accuracy { Bearing $\pm 0.4^\circ$
Range ± 0.8 Km

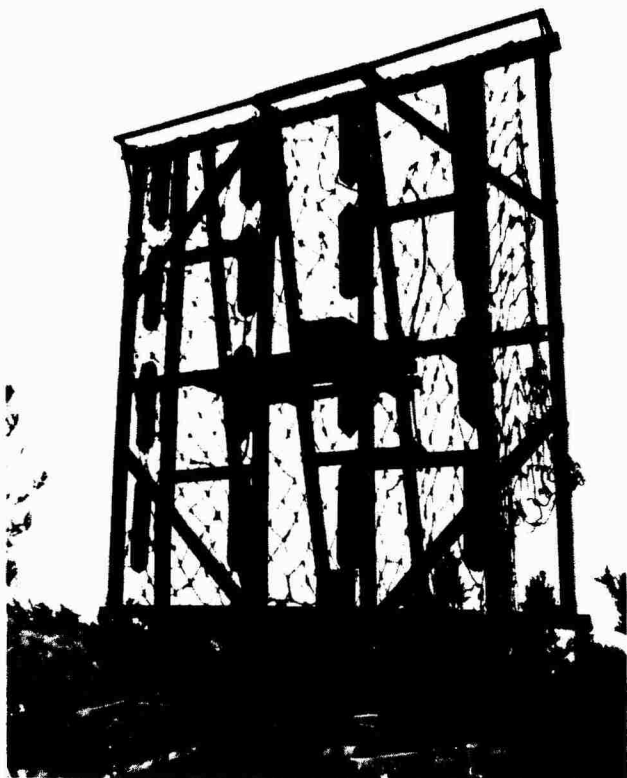


$\lambda = 2m$

Tin-plated Ironplate Elements
with Reflecting Net of 4cm mesh.

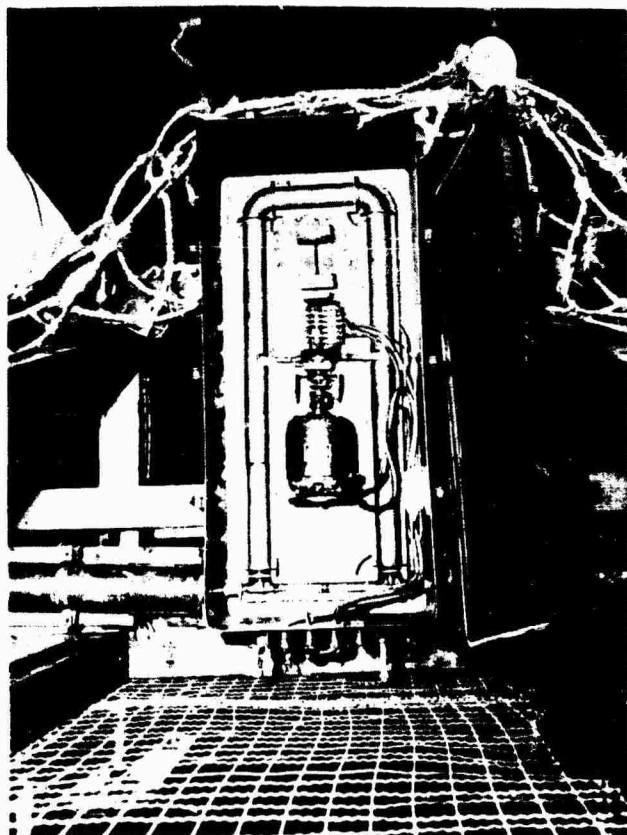
ANTENNA EQUIPMENT





Radar No. 62's
Broad Band
Antenna for
Interrogating
Friendly Fighter
GCI Operation
(150 MC + 5 MC)

Chigasaki



Detail of Lobe Switch Mounted
Behind Antenna Screen.

M-13

IFF - FRIENDLY AIRCRAFT LOCATING

Corresponding Allied Designation: ----

Technical Characteristics:

$f = 150 + 5 \text{ MC/S}$. 50 W. M-13 on sweep frequencies answers to Type 13 radar within 120 Km range when its altitude is 2000 M; also works on fixed frequency with No. 62 radar.

Number Built = 100.

Number Installed = *FEW*

Description:

This IFF transponder is designed to operate in either of two ways: (a) Its tuned frequency can be swept continuously through the $150 + 5 \text{ MC/S}$ band (similar to the American SCR-695). In this case it responds with the same frequency as it received. In this mode of operation any radar station (such as the type No. 13) in the 150 MC/S range can obtain identification signals from the plane which appear as regular or coded increases in the signal return seen on the ground radar's scope. (b) The sweep may be stopped and the M-13 receiver set to respond to some selected spot frequency; it will be set to retransmit at a different frequency as far away as 3 MC/S . With this arrangement it is especially suitable for GCI work in connection with the No. 62 ground set.

The response can be given any one of 5 different codes for added identification precaution. The operator in the plane can hear his own set if it is responding.

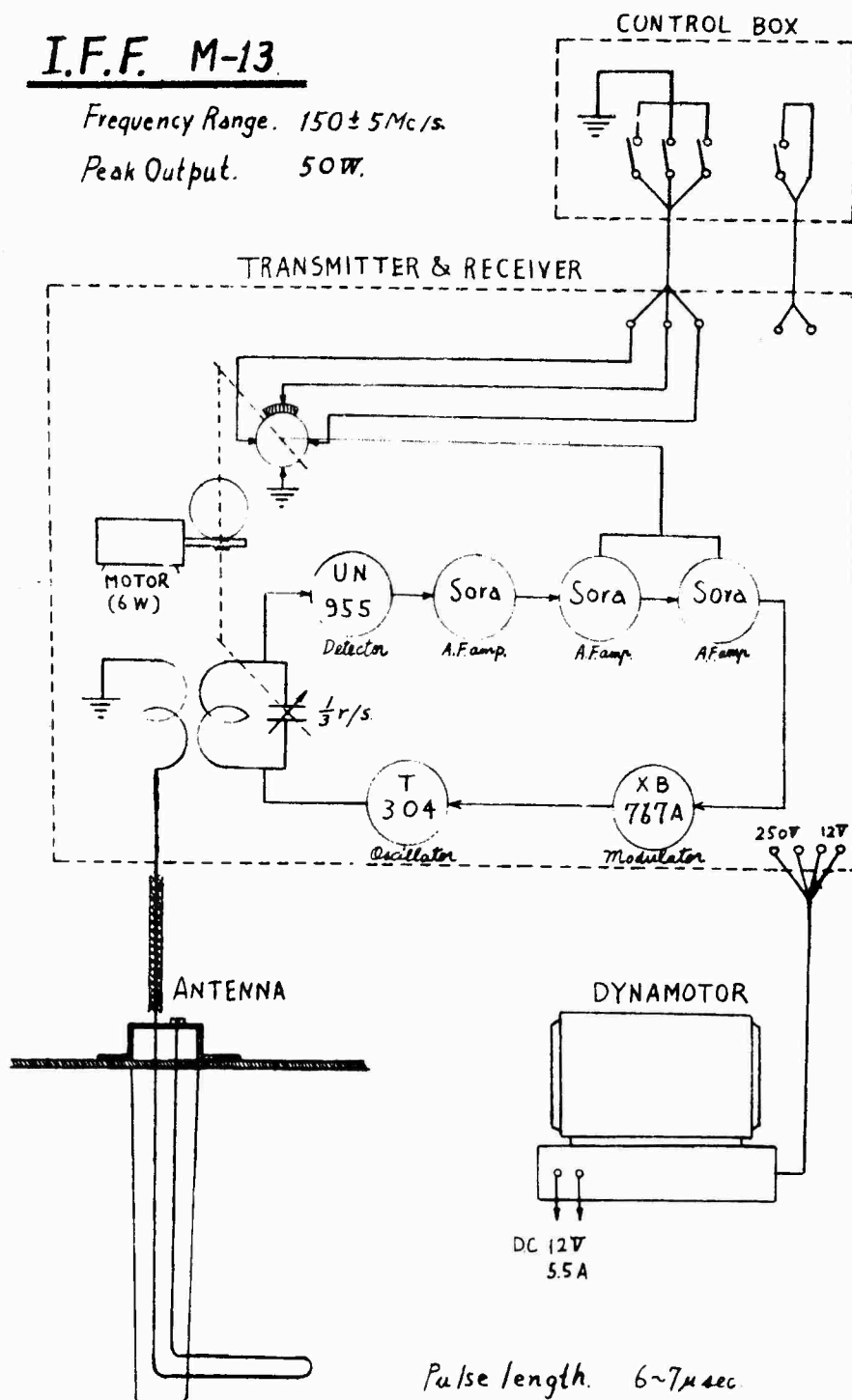
This set is quite different from the army IFF set which operates only in the (b) fashion but at higher frequencies. Hence the IFF's are only useful for the navy to identify navy planes, and for the army to identify army planes.

Five months were spent on the development of this equipment--and 4 months more were needed to get it into production. It was just coming into use by the navy as the war ended.

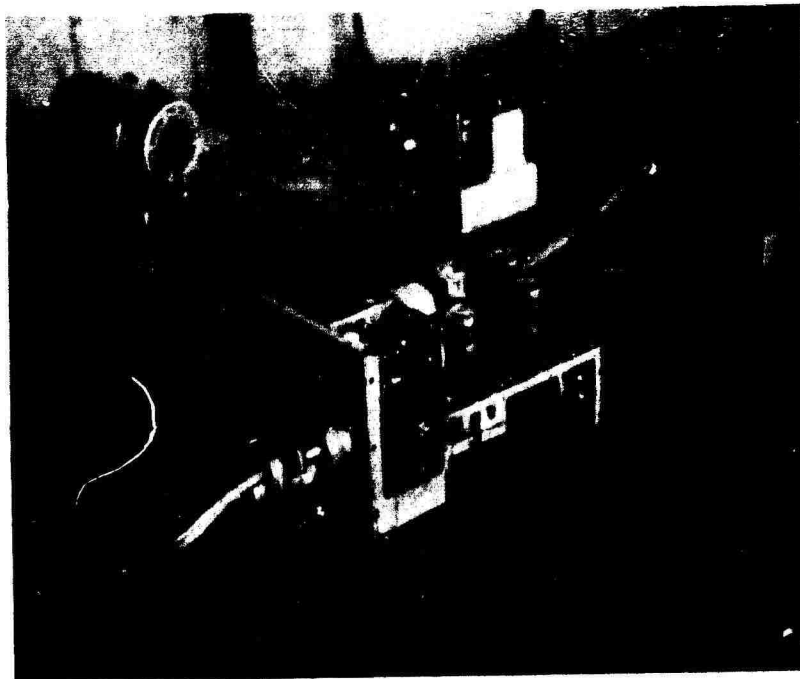
I.F.F. M-13

Frequency Range. $150 \pm 5 \text{ Mc/s.}$

Peak Output. 50 W.



M-13 answers to type-3 radar within 120 km. range,
when its altitude is 2000m.



M-13 Navy IFF Equipment - 2d Naval Technical
Institute - Kanazawa.

HAMA 63

FOE AIRCRAFT LOCATOR

Corresponding Allied Designation: ----

Technical Characteristics:

f = 100 MC/S. 40 KW. Range 200 Km.

Accuracy: Range, + 500 M estimated; Azimuth, unknown.

Number Built = Set in development. Number Installed = 0.

Description:

This radar was planned to be installed near an airfield where GCI operations could suitably be carried out. Its purpose would be to detect and then accurately locate an enemy plane and supply data on it until the fine tracking No. 62 radar could pick up the enemy plane and lock on it. Lobe switching at 1000 per minute provides the means for good azimuth accuracy.

An observation cathode ray tube is provided to view all returning echoes. A range tube gives range and gates the proper signal for the bearing tube.

This Set (No. 63) was still in its experimental stage when the war ended.

INTERCEPTION COMPUTER

The Japanese navy had developed an interception computer by means of which a control officer sitting in the ship's information center could quickly determine the proper instructions to the friendly fighter to make an accurate interception. Present positions, directions and speeds of both the friendly and enemy planes are set in on the dials. The computer shows the direction (azimuth) the interceptor should fly and how long it will be before he makes the interception.

This computer is similar to the Japanese army's Tachi-36.



FH-1

HEIGHT MEASURE

Corresponding Allied Designation: ----

Technical Characteristics:

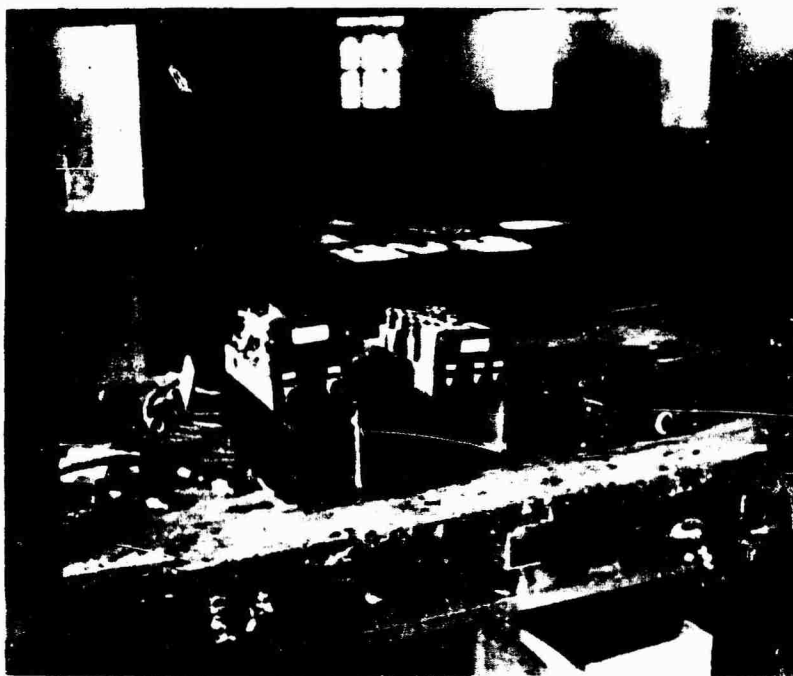
$f = 340 \pm 15$ MC/S - frequency modulation. 0.1 W. Range 10-150 M.
Accuracy of range, $\pm 5\%$.

Number Built = 100.

Number Installed = *NUMEROUS*

Description:

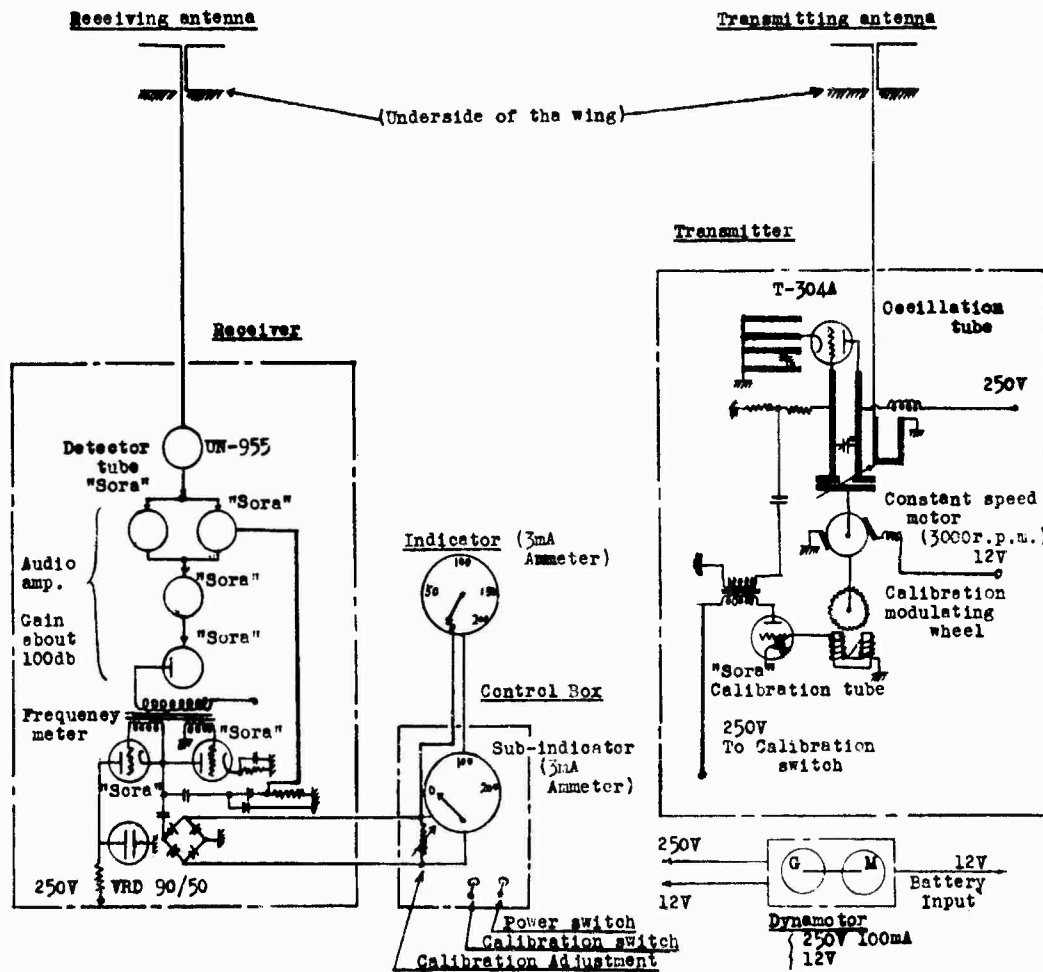
FH-1 is an FM absolute altimeter very similar to the army's Taki-13 and our own AN/APN-1. A motor driven tone wheel provides the modulating swing of ± 15 mc/s from the average of 340 mc/s. The return from ground signal is compared in phase with the direct signal, and the difference made to actuate an indicator reading the altitude from 10 to 150 meters. The Sora tube is used here as the "universal pentode." The navy radar people say this altimeter was widely and successfully used for torpedo attacks.

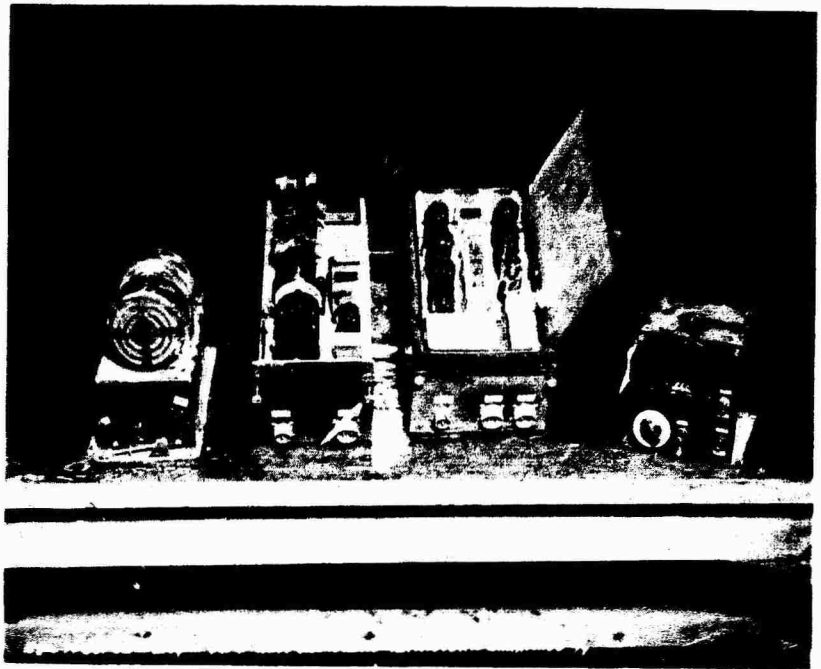


Bench Installation of FH-1 Altimeter -
2d Naval Technical Institute - Kanazawa.

Aircraft Radio Altimeter "FH-1"

Out put power: about 0.1W.
 Frequency: 340 ± 15 Mc (Frequency modulation)
 Range: From 10m to 150m
 Accuracy: about $\pm 5\%$





FH-1 Altimeter Showing Interior
of Components.

FTB

RADAR COUNTER MEASURE RECEIVER

Corresponding Allied Designation: ----

Technical Characteristics:

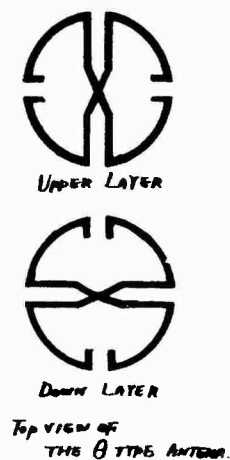
f = 81-660 MC/S. Azimuth Accuracy, $\pm 5^\circ$.

Number Built = 300. Number Installed = *NOT YET USED*

Description:

This is a simple high frequency radio receiver using a broad band omnidirectional search antenna, which can be replaced by a highly directive array when a signal is picked up. Signals are picked up through the ear phones provided, the radar's p.r.f. being heard as a tone.

FREQ RANGE: 81 ~ 660 MC./SEC.
WAVE LENGTH: 3.7 ~ 0.45 METERS.
ACCURACY: ± 5 DEGREES.



FTC

RADAR COUNTER MEASURE RECEIVER

Corresponding Allied Designation: ----

Technical Characteristics:

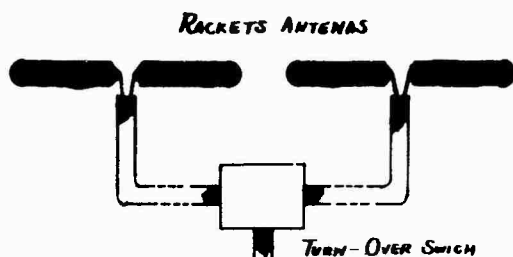
f = 81-660 MC/S. Azimuth Accuracy = + 5°.

Number Built = 100 unfinished. Number Installed = 0.

Description:

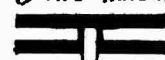
FTC is similar to FTB except that in addition to the aural indication a visual indication is given the pilot to turn either right or left to home on the intercepted signal.

RADER DETECTOR TYPE FT-C



FREQ RANGE: 81 ~ 660 MC/SEC.
WAVE LENGTH: 3.7 ~ 0.45 METERS
ACCURACY ± 5 DEGREES

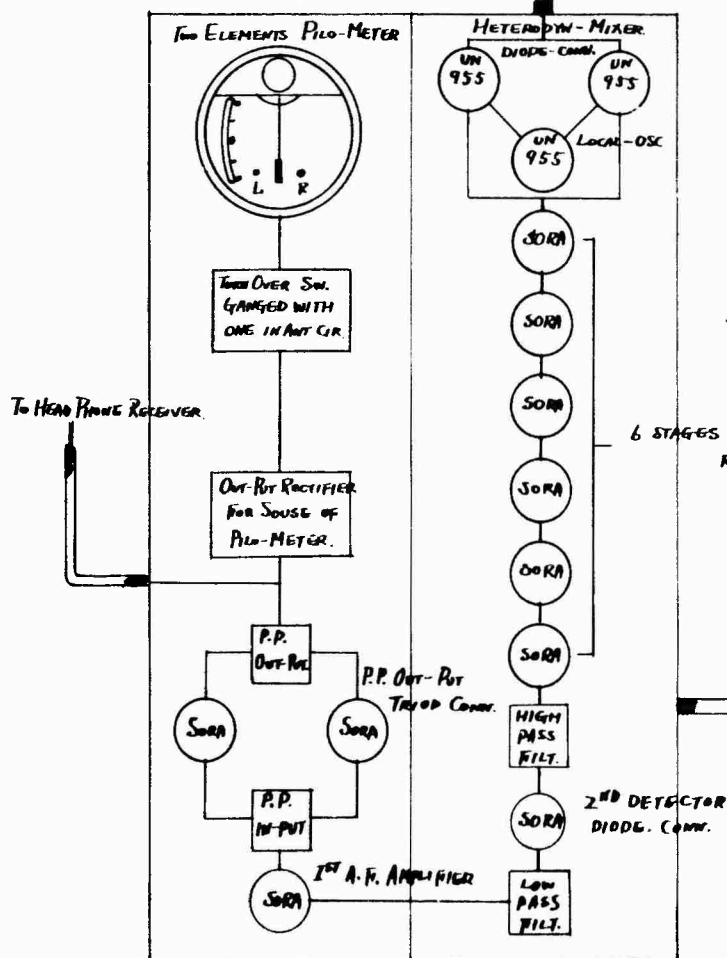
θ TYPE ANTENNAS



R-F FEEDER LINE
 $Z_0 = 160 \Omega$

TURN-OVER SWITCH

RECEIVER



Top View of
The θ TYPE ANTENNA

6 STAGES WIDE-BAND INTER-MEDIATE AMPLIFIER
RESIST.-CAP. COUPLING.

TYPE "U3" DYNA-MOTOR.

To 12 VOLTS
STORAGE BATTERY.

LAND BASED AND SHIPBORNE RCM SEARCH RECEIVERS

A number of search receivers for land and ship use are shown in the D-section of the large table preceeding the block diagrams of navy radar sets, whose diagrams are not included. For land use the range from 3 cm to 4 meters is covered by two equipments. The same receiver, E27 for 0.75 m to 4 m is used by the navy with a variety of antennas, some directional and some all-around, depending on the installation. Two more receivers going down to 3 cm coverage are available for shipborne use.

SUPPLEMENTARY

INFORMATION

DEPARTMENT OF THE AIR FORCE
AIR INTELLIGENCE AGENCY

MEMORANDUM FOR DTIC-BCR

ERRATA

AD-895 893

17 January 1994

FROM: NAIC/MSIR
4115 Hebble Creek Rd Ste 14
Wright Patterson AFB OH 45433-5618

SUBJECT: Freedom of Information Act (FOIA) Request, Case I-FASTC
93-37

1. Reference your letter 22 December 1993 and 18 October 1993 NAIC letter, same subject.
2. NAIC OPR has reviewed documents AD 895891 Volume I, AD 895892 Volume II and AD 895893 Volume III and determined that the records are fully releasable.
3. The documents identified above may be released to future Freedom of Information Act requesters.

ERRATA AD 895 893

Marlyene A. Harrison
MARLYENE A. HARRISON, GS-11, USAF
Chief, Freedom of Information
Information Management Operations

Attachment:

1. OPR Comments
2. Releasable Documents

DEPARTMENT OF THE AIR FORCE
AIR INTELLIGENCE AGENCY

~~AD-895893~~
AD-895893

MEMORANDUM FOR DTIC-BCR

ERRATA

17 January 1994

FROM: NAIC/MSIR
4115 Hebble Creek Rd Ste 14
Wright Patterson AFB OH 45433-5618

SUBJECT: Freedom of Information Act (FOIA) Request, Case I-FASTC
93-37

1. Reference your letter 22 December 1993 and 18 October 1993 NAIC letter, same subject.
2. NAIC OPR has reviewed documents ~~Volume I, Volume II and AD 895893 Volume III~~ and determined that the records are fully releasable.
3. The documents identified above may be released to future Freedom of Information Act requesters.

ERRATA AD-895893

Marlyene A. Harrison
MARLYENE A. HARRISON, GS-11, USAF
Chief, Freedom of Information
Information Management Operations

Attachment:

1. OPR Comments
2. Releasable Documents

DEPARTMENT OF THE AIR FORCE
AIR INTELLIGENCE AGENCY

MEMORANDUM FOR NAIC/DXL

6 January 1994

FROM: NAIC/MSIR

ERRATA

SUBJECT: Freedom of Information Act (FOIA) Request R-FASTC-93-37

1. The attached FOIA request is forwarded for your review and releasability.

2. It is regards to a previous request from Mr. Edward Kettler for paper copies of documents AD 895891 Volume 1, AD 895892 Volume 2 and AD 895893 Volume III entitled "A Short Survey of Japanese Radar." No documents were located in NAIC per telecon with DTIC, the request was forwarded to them. DTIC located the requested documents and has forwarded them to NAIC for review and release determination.

3. Please ensure the branch chief signs the 1st Ind and records the time expended on DD Form 2086. After completing the required actions on this request, please call extension 77236 for pickup.

ERRATA



JOHN A. MCGUIRE, MSgt, USAF
Asst Chief, Freedom of Information
Information Management Operations

3 Attachments

1. AD 895891 Volume 1
2. AD 895892 Volume 2
3. AD 895893 Volume 3

1st Ind, NAIC/DXLA

DATE: 6 Jan 94

TO: NAIC/MSIR

1. The following apply:

 x Records are fully releasable.

Records should be:

 Fully denied under: Partially denied under:

Exemption: 1 2 3 4 5 6 7 8 9

2. Individual who worked this request/point of contact:

Name: Sherry Jennings

Office Symbol: DXLA

Phone number (black): 72435

3. Remarks:



ANITA L. MILLER, CHIEF
DOCUMENT REQUIREMENTS & ACQUISITION BRANCH